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The Marine Engineer.

LONDON, APRIL 1, 1893.

THE Naval Estimates this year have caused considerable discussion owing to the fact that whilst the shipbuilding programme includes three battleships and two first-class cruisers, we are furnished with none of the usual details of any of these craft save of the smaller of the battleships. It appears, however, that the 12-inch gun is the weapon to be relied on, the greater guns having already proved their unreliability. We learn, too, unofficially, that the cruisers are to be superior to anything of the kind afloat either in our own or foreign navies. They are to be named *Powerful* and *Terrible*, and are the reply to the Russian *Rurik*. That vessel is 435 ft. long by 67 ft. beam, the displacement being nearly 11,000 tons. Our cruisers are to be 65 ft. longer, and to have 3 ft. more beam, so that they will be considerably larger. The length, too, which is equal to that of the Cunard *Umbria*, is something exceptional for a war vessel. The old five-masted battleships, *Minotaur* and *Agincourt*, with their 400 ft. of length, have been the longest ships in our Navy. This great length should give the new vessels exceptional qualities in heavy weather, and we shall await further details with great interest. The smaller of the battleships is to be an improved *Centurion*, whilst the two larger ones are be improved *Royal Sovereigns*. This has excited the ire of Lord Brassey, who, as our readers well know, is an advocate of a restriction in the size of battleships. Three second-class cruisers of the *Astræa* type, but exceeding that vessel by 1,140 tons displacement, and excelling her by half a knot in speed, are also to be laid down. Twenty torpedo boat destroyers, of a speed of 27 knots, are included in the programme, and six of these are already in hand at the yards of private builders. Ten first-class torpedo boats are also provided for. This is not a day before they are wanted, and considering our weakness as compared with foreign navies in this department we hope that this instalment may soon be followed by a larger one. Perhaps, however, the most important points in the present Estimates are those relating to the personnel of the Navy. Provision is made for an increase of 2,600 men over the current year, and certain changes are to be made in the Royal Naval Reserve. The honorary Commissions are to be abolished, and in future the possession of a commission in the force will show that the holder has actually served a year in the Navy. This is very important, and it brings us to the consideration of the position of engineers in the force. This subject is having attention in Parliament, and no doubt now that the Admiralty are beginning to perceive the all importance of the engineer, they will recognize the necessity of treating him fairly and offering him reasonable attractions. Meanwhile, one of the leading shipping firms has issued a circular to all its engineers insisting upon their joining the force. This proceeding has excited comment, and questions have been asked in Parliament on the subject. It is easy to see the shipowners' position in the matter. All their vessels are likely to be requisitioned either as armed cruisers or as transports in time of war. Then either Naval or Royal Naval Reserve Engineers will have to be in charge. The shipowner knows well what the naval authorities are beginning to recognize, viz., that engines have their idiosyncrasies, and need humouring as it were. They do better in the charge of those who know their peculiarities. A hastily mobilized man-of-war, with no one in the engine-room who has ever seen the engine under steam before, is not likely to fulfil the paper promises, and will be lucky if she escapes disaster. This point does not escape business men, and they are naturally trying to make provision that their own people may remain on board under all circumstances. The feeling is very natural, and as long as the engineers are met fairly in the matter by the owners—as we are sure they will be—there is no reason to find fault with the requirement. Reverting once more to the Estimates, we cannot fail to recognize that the new Board of Admiralty is continuing the policy inaugurated by its predecessors. The present Estimates are an abundant proof that whatever may be the Government of the day we may still feel sure that the vital importance of the Navy will be recognized, and there will be no fear that, to court a fleeting popularity with the tax-payer, this department, upon which our national existence depends, will be allowed to fall from its pre-eminent position.

THE annual meeting of the Institute of Marine Engineers, which was held, on March 10th, at the Institute premises, 58, Romford Road, Stratford, is an excellent occasion for us to tender our congratulations to this rising Institute upon their rapid rise to an honourable position, and their very healthy financial status. Mr. Archibald Thomson (Vice-President) occupied the chair, at this, the fourth, annual meeting of the Institute, and expressed to the large attendance the gratification they might feel as to the great prosperity that had attended the Institute. He stated that at one time some people had thought that it would be but a very short lived affair, but the rapid progress of the

Institute, and its present very stable position, had afforded a complete contradiction to that supposition. The Chairman reported that at present the Institute embraced over 650 members, and it is well known that the leading lights in shipbuilding, science, naval architecture, and marine engineering were pleased to lend their support and countenance to the undertaking We have frequently in our columns had occasion to. reproduce or discuss the many papers of very great interest to marine engineers, that have been contributed to the meetings of this Institute, and we are glad to see that the volume of Transactions is constantly on the increase, as regards size and value of its contents. From the report of the Hon. Secretary, the indefatigable Mr. James Adamson, we see that the Institute is not disposed to remain satisfied with the accommodation they can at present afford, but are desirous of improving the structure of th e Institute to provide betteraccommodation for meetings. Neither are facilities for better pastime or instruction forgotten by the Council, and the items of proposed extension include both a better billiard-room and the extension of classes and lectures for drawing and other branches of technical education. Much development may also be expected in local branch centres in various sea-port towns, and there is already a favourable report of work done and or ganisation effected in the Bristol Channel Centre We are glad to see that the Institute commence their schemes of development at head-quarters on the exceedingly stable and permanent basis of being their own landlords and freeholders. The Institute, through its Honorary Secretary, also seems about to give its attention to that most burning and important question, which has already been ventilated in our columns, as to a proper qualification of firemen and third engineers, by certificates. This is the right spirit. Let the Institute look after the status of the members of the profession, even to its humblest items, and there is no doubt the profession will in return look after the status and flourishing condition of the Institute. *Floreat Marine!*

We are glad to see that mild steel as a material for boiler plating is steadily making its way into favour with the powers that be, as regards its trustworthiness and reliability. This is as it should be, as it is well that all new materials, until they have actually gained their character from experience of them, should be looked on with some diffidence and caution. We are glad to notice that the Board of Trade rules for [illegible] pressure allowed with steel boilers have in- [illegible] over 10 per cent. in the rules for 1893, as [illegible] those for 1891. This is, to our mind, very intelligible, and would indicate that under the searching light of test and experience, mild steel boilers are thought 10 per cent. better at the present time than they were two years ago. This is doubtless due to either better worked material or better workmanship or joints in putting together. The most approved joints for large boilers are double butt straps, which are credited with 80 per cent. efficiency as compared with the plain shell. We are, however, much troubled and perplexed to see our leading authorities on all scantlings and strength of boilers, differ one with another, and if we examine and admit the logical porportions of scales of working pressures in the case of steel boilers, adopted by one authority, we are unable to follow the logic of another set of results, which do not follow the same proportion with those from the other authority or relatively with one another. We are thus reduced to the same dilemma as is the patient when "doctors differ." To illustrate our meaning we give below a short comparative table of the working pressures allowed by the Board of Trade in 1891 and in 1893, and by Lloyd's for 1892 to 1893. The joints for 12 ft. boilers are double butt strap joints, and have an efficiency of 80 per cent. The 5 ft. boilers have lap joints only, with an efficiency of 70 per cent. to 75 per cent. of the steel shell.

			B.T., '91.	B.T., '93	Lloyds, '92, '93.
1.—12 ft. diam.	½ in. thick.		70·8 lbs. w.p.	78·48 lbs. w.p.	68·6 lbs. w.p.
2.—12 „ „	¾	„	106·2 „	117·7 „	111·1 „
3.—12 „ „	1	„	141·6 „	157·0 „	155·5 „
4.—12 „ „	1¼	„	177·0 „	196·2 „	200·0 „
*5.— 5 „ „	½	„	150·4 „	176·8 „	138·7 „
*6.— 5 „	⅜	„	105·2 „	116·06 „	86·3 „

* Lap joints of say 70 to 75 per cent.

If now we examine the Board of Trade columns, we see an improved credit of about 10 per cent. given to the steel boilers by two years' experience, on which we have already remarked as quite logical, and to the credit of the former caution of this authority. If we examine also the results for the large and small boilers, we find they are all exactly proportioned to one another on the most simple and logical grounds. As, for instance, in the first and third boilers the only difference is a double thickness of plate which gives a proportionate increase of tensile strength in the shells, and an exact duplicate working pressure. If 1, 2, 3, and 4 are compared we can see that the relative working pressures in the Board of Trade columns are exactly proportioned to the relative thicknesses of the shell, all other things being the same, size of rivets and efficiency of joints remaining in same ratio. Also in the smaller boilers this same simple and logical sequence exists. The effective internal bursting pressure on a boiler increases with the diameter, and the safe working pressure, therefore, increases as the diameter diminishes. Hence the

working pressure of the small boilers, 5 and 6, may be deduced from those of the larger boilers, by a comparison of the inverse ratios of the diameters, and the direct ratios of the thickness of the plates after allowing a special deduction of one-tenth to one-eighth for the smaller efficiency of lap joints compared with the butt joints. But after this cheering and simple analysis of the Board of Trade rules, what are we to do with the anomalies of the figures in Lloyd's column? We are afraid we must do "what the other donkey did," give them up. We have only to point out that in Lloyd's column the working pressure of No. 3 is not twice that of No. 1, although the only difference is a double thickness of plate. Were the working pressure of No. 3 less than double that of No. 1, it might be argued that the strength of a boiler does not really increase as the thickness of the plate, other things being the same, owing to the difficulty of working, and liability to straining and cracking of a heavier plate. But No. 3 is allowed a greater working pressure than double No. 1. Also, though 1, 2 and 3 have less working pressure allowed than by Lloyd's than the similar boilers under the Board of Trade, No. 4 is allowed 4 lbs. over. In the small boilers also, the working pressure allowed by Lloyd's runs from 20 per cent. to 30 per cent. less than that allowed by the Board of Trade. We cannot explain these anomalies, but if there is an explanation, it would appear to be that in the view of Lloyd's surveyors, a boiler of given diameter, with a various thickness of shell, decreases in its work carrying capacity in greater proportion with thin shells than is due merely to theoretical calculation, and further, that as compared with boilers of large diameter, boilers of smaller diameter do not increase in strength in the theoretic proportion of the reduction of surface by reduced diameter. We are quite willing, "when found, to make a note of it," but so far, without explanation as to these curious deductions, we doubt thereference.

Passengers to and from leading cities and towns on the Continent will, no doubt, much appreciate the new route to that part of Europe, *viâ* Harwich and the Hook of Holland. We are informed that on and after the 1st of June next, the steamers of the Great Eastern Railway Company running between Harwich and Rotterdam, instead of proceeding up the river to the latter port will go to the Hook of Holland and there land and embark passengers and goods at the new quay which has been built at this place. The quay is situated on the northern bank of the new waterway at the entrance to the Maas, and consequently the time occupied in the passage up the Maas will be saved to travellers to Holland and Germany. In connection with the arrival and departure of the steamers, express trains will be run by the Holland Railway Company to and from the leading Dutch towns, to and from Cologne (for the Rhine and South Germany), *viâ* Rotterdam and Geldermalsen, and to and from North Germany *viâ* Amsterdam and Salzbergen. The services will be run on Sundays as well as on week-days. Passengers for Holland and Germany will leave Liverpool Street Station at 8 p.m. as at present, and will reach the Hook of Holland at 5.50 a.m., Rotterdam at 7.16 a.m., Amsterdam at 8.26 a.m., Hamburg at 10.20 p.m., and Berlin at 10.36 p.m., so that on and after June next appreciable time will be saved in arriving at these places from Harwich, compared with that now occupied. Direct trains will be run to and from the Midland and Northern Counties and Scotland and Parkeston Quay, Harwich, in connection with the arrival and departure of the steamers. In February the *Chelmsford*, one of the new steamers which the Great Eastern Railway are having built for their new route, was launched from Earle's Shipbuilding Yard at Hull. This is the first of three steamers of the same type to be built for the company's new service between Parkeston Quay and the Hook of Holland, at a cost of more than £200,000 Each of them will be twin-screw boats, and will be well illuminated by electricity, and can be propelled at 17½ knots, and will make their voyages in about six hours. The *Chelmsford* has excellent accommodation for 200 first-class and 64 second-class passengers. An appreciable new feature in these steamers will be special private cabins for two passengers without any additional charge. The present steamers of the Great Eastern Railway Company running between Harwich and Rotterdam and Harwich and Antwerp, although excellent as regards superior comfort and accommodation in their saloon and cabin and sanitary arrangements, are considerably slower in speed than many cross-Channel steamers of other English Railway Companies. This deficiency will, however, cease as to the three new steamers referred to, which will, as regards their combined merits, be splendid models of short sea voyage passenger ships. One great improvement is required in connection with the train service to Berlin from the Hook of Holland in order to shorten the journey to that German capital, and this is the acceleration of trains between Rheine and Löhne, on which line at present only slow trains are run. If these are substituted by proper express trains, to start immediately after the arrival of the fast trains of the Holland Railway at Rheine from the new Dutch landing quay, the service between London and Berlin will be express throughout, and when the new steamers are running

there will be saving of time of three hours at least on the present route, so that passengers leaving London at 8 p.m. would reach Berlin at 8.30 the following evening. Lord Claude Hamilton, the deputy-chairman of the Great Eastern Railway Company, and Mr. Gooday, the Continental traffic manager, have visited Berlin with the view of inducing the German railway officials to run fast trains, so as to reach Berlin at the last stated time, and similar trains on the return journey to the Hook of Holland in connection with steamers from thence to Harwich. There is reason to believe that such fast trains will be provided. In this event there is likely to be an enormous additional number of passengers between England and the Continent *viâ* Harwich, for whom the Great Eastern Railway will provide estimable accommodation, and will increase it according to the true exigencies of the times.

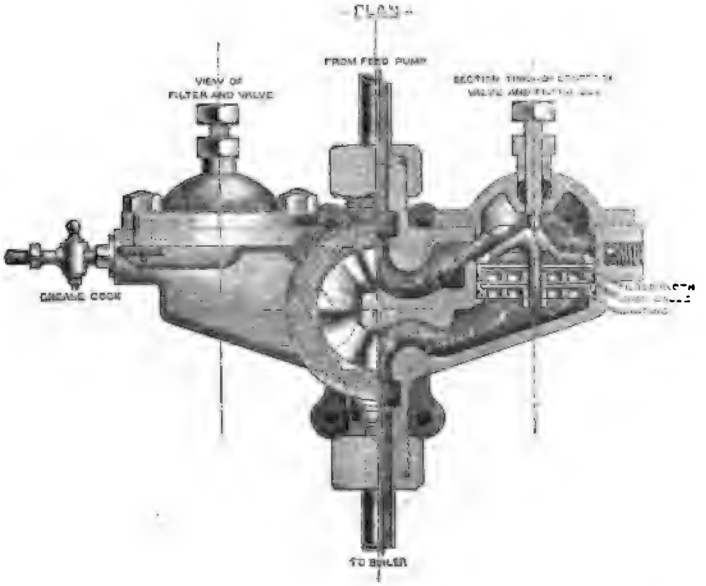
The Institution of Naval Architects celebrated their annual banquet on the evening of March 22nd in their usual enjoyable fashion, at the Holborn Restaurant, with Lord Brassey as president, and all the other shining lights of naval construction, engineering, shipping, and science duly represented at their hospitable board. Not only were we personally much gratified by the excellent cheer provided, but on behalf of the rising and numerous profession of Marine Engineering, whose interests we may perhaps be considered to have in some degree represented, were we most gratified by the warm welcome and recognition extended to the Marine Engineers by their elder and perhaps hitherto rather exclusive fraternity. Sir Edward Harland, who has done so much in the Sister Isle to raise the credit of private yards in the construction of the finest sea-going liners, made most pointed allusion in his toast of "Our Guests," to the enormous increase of importance of the science and practice of Engineering to the profession of Naval architecture. As he said, "even 25 years ago the naval architects would have snapped their fingers at the engineers"; but those were the days of wooden walls, and now the shipbuilder could not do without the engineers, and they had had the prudence to claim them as twin-brothers—and to bow to them with the greatest deference. He hoped the artificers and engineers of the Navy would not only show themselves worthy of a position among the naval officers, which they had honestly won, but ·y would be placed in that proper posi- he Navy to which they were eminently Even the gallant Admirals whom he saw m would be rather put to straits if they found the first, second, and third engineers had suddenly taken the colic when the ship was out at sea or about to attack an enemy. Those gallant officers would almost wish that they themselves had been artificers in their youth, and could go into the engine-room and either stop or start the engines as might be required. It is worthy of note also that the very popular Chief Constructor to the Admiralty, Mr. W. H. White, who was actually called on to reply to the toast of "Success to the Institute of Naval Architects," has already generously given his countenance and support, as president elect to the young but rising Institute of Marine Engineers, of which we have so long been the ardent admirer and advocate in the interests of that profession. In his reply he disclaimed that there was any need for the naval architect to have forced upon him the recognition of the engineer, and claimed that the title of the Institute of Naval Architects was not limited for the purpose of putting marine engineers into a second place, but because he believed marine engineers desired the title to be as it was. This is the first time that we have heard that it was the marine engineers who were god-fathers to the Institute of Naval Architects, but we bow to such good authority, and will take the evident will for the deed that for the future naval architects and marine engineers are to be twin brothers.

EDMISTON'S FEED WATER FILTERS.

As these appliances are now coming largely into use, we give our readers illustrations of two of the most important designs, viz., the "Navy," as supplied to the Admiralty, and the "Scot," as supplied to the "Union," "Royal Mail," "British India," and Mercantile Service.

The essential object of the apparatus is the purification of feed-water from grease and oily matters, which are known to be so injurious to the boiler. From numerous extensive and elaborate experiments made by the highest authorities, it has been ascertained that the burning and collapsing of furnaces is in most instances traceable to oil or grease settling on them. This happens, according to the investigations of Professor Lewis, even when the finest qualitie sof oils are used. Mr. Edmiston, the original inventor and patentee of this new filter, found, after making a large number of experiments on a practical scale, in connection with high and low pressure boilers, that every particle of grease or greasy matter is arrested by its employment. It is also demonstrated, through an analysis of deposit made by Dr. Norman Tate, of Liverpool, that other materials highly injurious to the boiler are separated from the feed-water in its passage through the filter, these substances including oxide o copper, iron, lead and tin, with silica or fine sand, etc

The fact of such ingredients as these being kept out of the boiler greatly reduces the hardness of the scale as well as considerably diminishing its quantity, and it may be said that the economy in cleansing and scaling alone is generally sufficient to pay the expenses of the filter in a short time. The removal of grease and scale, which form highly non-conductive deposits in the boiler, also carries with it very considerable economy in fuel, as a mere film of oil on the heated surfaces has been demonstrated by Professor Lewis to retard the heating properties of the fuel by as much as 50 per cent. Between the gratings shown in the sectional view are placed three thicknesses of wire gauze and flannel. The feed-water passes through these layers, which retain any impurities contained in it, such as oil, fatty matters, and the like, those substances that sink in water being drawn off by the drain, and the scum-cock serving to clear the box of grease which has a lower specific gravity than water.



When the pressure gauge on the box shows an increase of 10 lbs. above the ordinary pressure, the feed-water should be diverted and the filter cleaned.

A special valve has been invented by Mr. Basset, of Maudslay's firm, in which the five valves commonly required for the double arrangement of filters and bypass are replaced by a single valve of peculiar design. It is so contrived that, no matter in what position its spigot is turned, the current of the feed-water receives no check in velocity. There is therefore no risk of the feed-pumps bursting the feed-pipes.

This design is more especially adapted for engines up to 500 H.P., and for these sizes is a decided economy. These filters are made to stand any test-pressure in ordinary use. The construction of this valve will be clearly understood upon reference to the sectional views.

The business is in the hands of the Glasgow Patents Co., Ltd., Wellington Works, Glasgow, who supply the Merchant Service, Messrs. Maudslays, Sons, & Field, Ltd., holding license for manufacturing and supplying to warships.

THE INSTITUTION OF NAVAL ARCHITECTS.

THE annual meeting of the members of the Institution of Naval Architects opened at noon, Wednesday, March 22nd, at the rooms of the Society of Arts, Adelphi. The Earl of Ravensworth presided, and there was a large attendance, which included Lord Brassey, Sir Frederick Bramwell, Sir Nathaniel Barnaby, Mr. W. H. White, Director of Naval Construction, Admiral Sir John Hay, Vice-Admiral Colomb, Admiral Sir E. Fanshawe, Admiral Sir Vesey Hamilton, and Sir Edward Harland, M.P.

The Secretary of the Institution (Mr. George Holmes) read the annual report of the Council for the past year, which was as follows:—"The Council reports with much pleasure that the Institution continues to flourish, and has made satisfactory progress during the last year. This state of things is reflected in the accompanying statement of receipts and expenditure. The only item of receipts which shows any noteworthy diminution is that of the entrance fees of new members, and this is due solely to the fact that no summer meeting was held during the year. The Council announces with much regret that the Earl of Ravensworth, who for 14 years has rendered invaluable service to the Institution in the capacity of its president, has signified his intention of retiring from that office at the close of the annual general meetings. Acting under Bye-law 30, the Council have decided to recommend Lord Brassey, K.C.B., one of the vice-presidents, to the general meeting for election as president. The Council, however, has much pleasure in stating that the Earl of Ravensworth will not sever his connection either with the Institution or the Council, but will continue to give his colleagues the great benefits of his advice and assistance in the capacity of vice-president. Acting under Bye-law 5, the Council have elected Lord Ravensworth an honorary associate of the Institution as a small recognition of his great services. The Council received in the early summer of last year a most cordial invitation from the Mayor and Corporation and the Chamber of Commerce and Shipowners' Society of Cardiff to visit that thriving port in the month of July last. The invitation was accepted, all the arrangements were made for a summer meeting, and a programme of exceptional interest—and characterised by magnificent hospitality—was prepared by the local reception committee; but, unfortunately, the hopes of holding a meeting, which would have been memorable even among the many successful summer meetings which the Institution has held, were frustrated by the general election of last summer, which was found to interfere so seriously with the prospects of the meeting that the latter had to be postponed. The Council, however, has much pleasure in announcing that the invitation from Cardiff will be renewed this year, and trusts that the members will do all in their power towards making it a success. The

Council announces, with great regret, the death of one of its most valued and distinguished colleagues, the late Dr. A. C. Kirk, LL.D., F.R.S.E. Dr. Kirk's loss leaves a gap which will not easily be filled up, either in the profession or in the institution. His services will be duly recorded in the pages of the "Transactions."

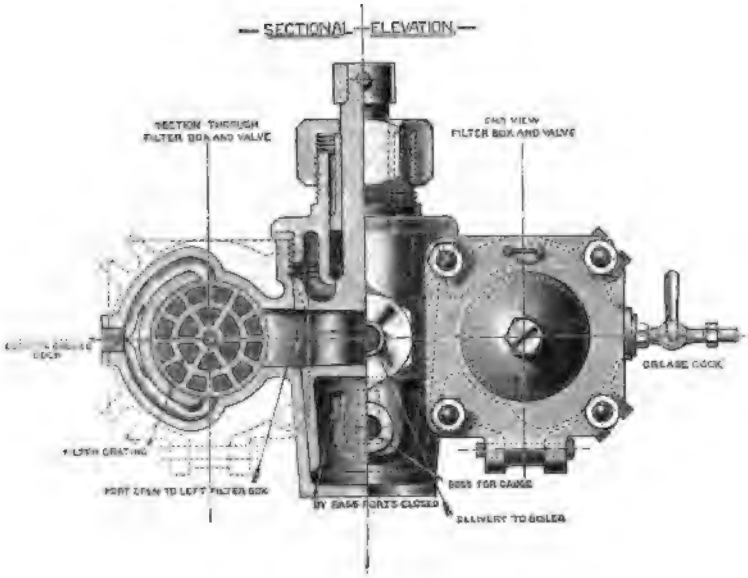
The list of officers and Council for the ensuing year, with Lord Brassey as president, and the Earl of Ravensworth as vice-president, was unanimously accepted.

The Earl of Ravensworth congratulated a very old, esteemed, and valued friend, Lord Brassey, upon the honour conferred upon him, and the institution upon having had the good fortune to obtain the services of so eminent a man, so thoroughly qualified for the position in which the members had placed him.

Lord Brassey, who was cordially received, said:—Words fail me to express adequately my grateful appreciation of the compliment which the members of the Institute of Naval Architects have been pleased to pay me in electing me to be president of your most valuable and important association. I have done nothing to merit that honour. But I will do my utmost to render useful service, and I can truly say that any work which is undertaken by me in connection with the great maritime interests of my country is for me a labour of love. The sea was the passion and the dream of my boyhood; and it has largely engaged the labours of my manhood. My interest in the subjects which engage the attention of naval architects was keen and constant even before the foundation of this great Institution, now 32 years ago. In endeavouring, as I hope I always shall do while I am your president, to make myself of service to you, I know that the best thing I can do is to strive to follow in the footsteps of those who have preceded me in this office of president. During a long and distinguished tenure of office Sir John Pakington was unflagging in his devotion to your interests, and to-day, in the presence of your retiring president—my old and valued friend, Lord Ravensworth—it is difficult, indeed it is not possible, to say all that I and you feel of gratitude, and admiration, and personal regard. He has always kept himself abreast of all that is going forward, both in the Royal Navy and in the Mercantile Marine. All his addresses have been luminous, comprehensive, and suggestive. His tact has never been at fault; and he has been singularly happy in turning official relations into friendships. Though retiring now from the responsibilities of the office of president, we shall not regard his resignation as a parting—we shall hope to see him often in our midst, and whenever he comes he knows that he will receive a most cordial and affectionate welcome. I ought, in a sentence, to express the sense which I and the public must have, that a great institution of this kind is not the creation of one or two individuals. Certainly those who have filled the office of president cannot claim the monopoly of the credit due to the successful founding and working of such an institution. It has been a most successful Institution, and the idea of founding it was most felicitous; and the credit of it lies with men whom we shall never forget—Mr. Scott Russell, Mr. Samuda—and we have still amongst us another man prominent in the founding of the Institution, Sir Edward Reed. I can only again express to you my most sincere gratitude.

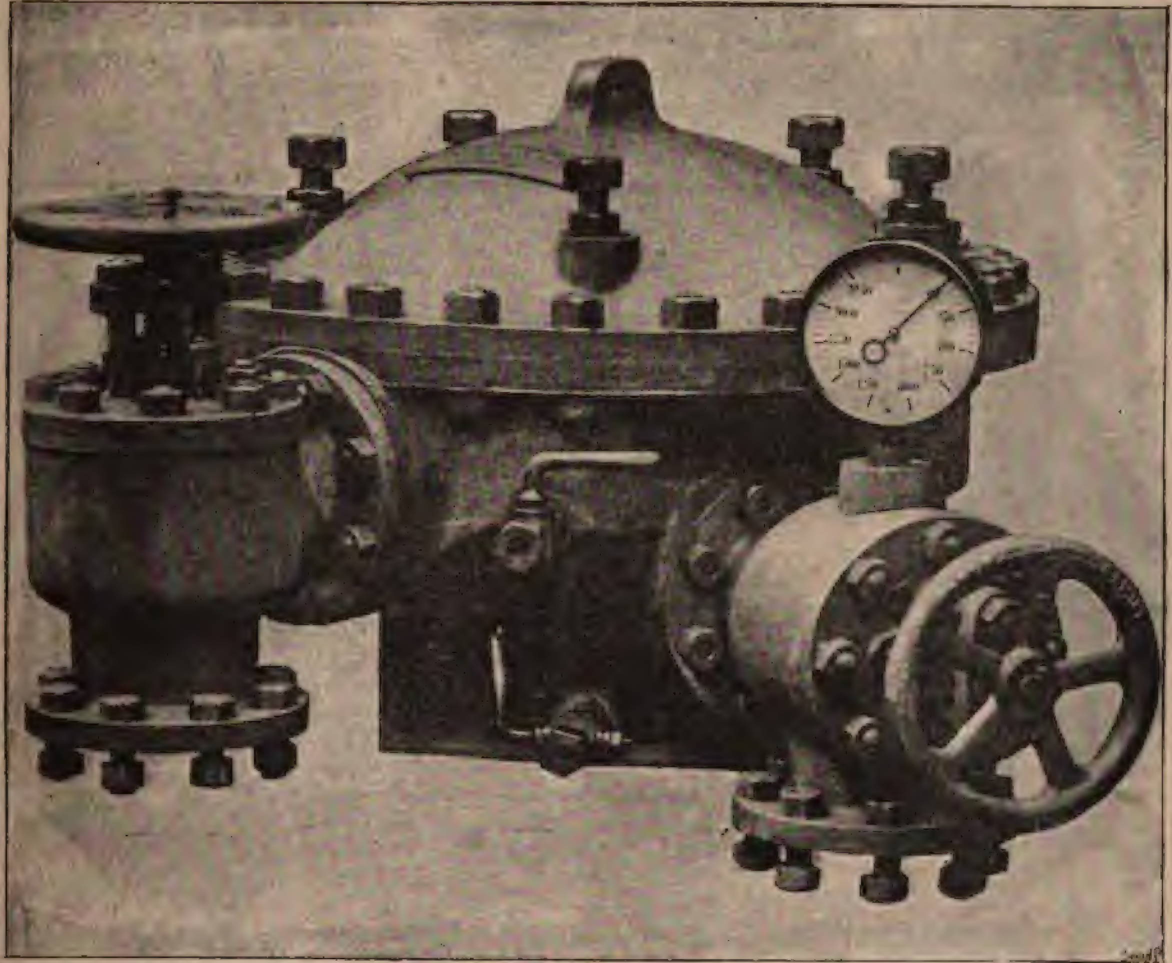
The new members and associates nominated for election were then declared elected.

The Earl of Ravensworth, in moving the adoption of the report, said:—Let me congratulate you, one and all, upon the statement of your position, which is a very flourishing one, and the statement of accounts will show that your financial position is a sound one, and in some respects, an improving one. It must be interesting to you all that the negotiations which have passed with the authorities at Cardiff have ended in a most successful manner, and have resulted in a most gracious invitation from Cardiff to hold our summer meeting in that great rising, and most important seaport, which holds something like one-third or one-fourth of the export trade of the kingdom. The invitation is couched in terms so cordial, and so hospitable, that I have not the slightest doubt that you will be met by an overflow of Welsh hospitality. I would make an earnest appeal that a large number of members will attend the summer meeting at Cardiff, so that there may be a good meeting, and so that our Welsh friends may not be disappointed. I need not refer further to the appointment of Lord Brassey as your president. I firmly believe you have put the right man in the right place. The noble Earl then alluded to the great loss which the institution had sustained by the death of Dr. Kirk, who was closely identified with the success of the triple-expansion engine. Dr. Kirk was not, and never claimed to be, the absolute inventor, because two years before the triple-expansion engine was tried on board the *Propontis* under his auspices a gentleman of the name of Fergusson, connected with a Glasgow firm, used the engine, and it was a curious fact that the new apparatus was shipped on board a ship in the East under the auspices of an engineer named Russell: but Dr. Kirk took up the invention, and carried on his experiments until he achieved his success on board the *Aberdeen* in 1881. The triple-expansion engine had now become the ordinary means of locomotion, both in the merchant navy, and in the Royal Navy. He was sure the institution would join with him in an expression of deep condolence with the family of Dr. Kirk, and he condoled with the institution on the loss it had sustained by his death. Proceeding to refer to events of interest which had occurred during the past year, he said:—First of all, I regret that it is utterly out of my power to offer you anything like congratulation on the business of the past year. I believe I am not exaggerating when I say that trade generally not only in England, but all over the world, is now in a state of depression, which we trust may be shortly removed, and I confess I see no visible signs of an improvement at present. But of all our industries, there is none which has suffered more acutely than the great shipping interest.



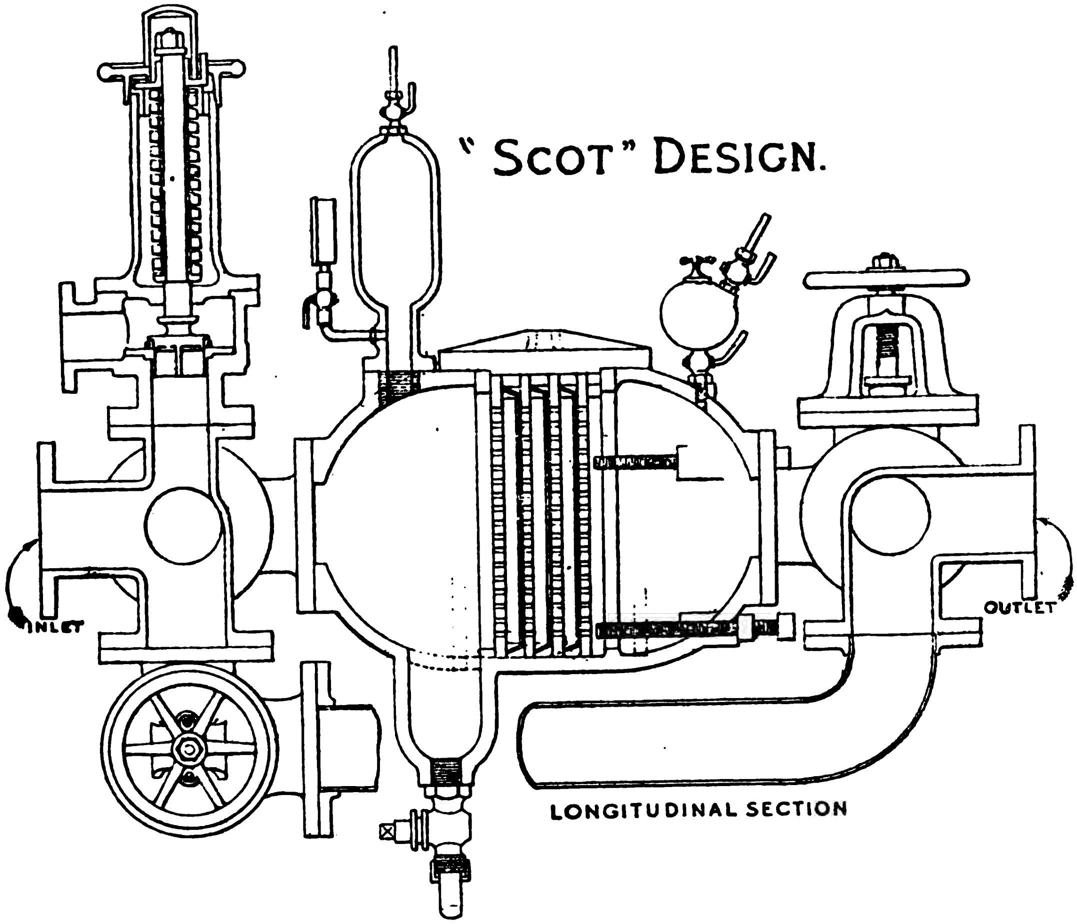
EDMISTON'S FEED WATER FILTERS (*See page 4*).

The state of the freight market and the number of idle ships tell their own tale. In the Tyne alone, at the end of February, there were 150,000 tons of idle ships laid up, and in the ports of the United Kingdom at that period there were something like 500,000 tons of idle ships. When you consider the amount of capital bound up in those vessels, the condition of the freight market, and the almost utter absence of demand you can form some idea of the extent of the depreciation in the value of shipping property. I never like to be sanguine, but I do not see any very evident sign of improvement. We hope, however, that with the improvement in the Baltic ports, and the reduction in stocks which must have occurred during this long period of depression, there may be some prospect of improvement towards the end of the year, but we cannot look for any very great activity in our shipbuilding yards, nor is it probable that any great demand for new tonnage is likely to arise at present, because, in spite of the low freights and the number of tons of vessels month by month laid up in our respective ports, there was a nett addition to the steam tonnage last year of no less than 435,000, and of 115,000 in the sailing tonnage. The steam tonnage actually showed an increase over 1888, although the annual increase upon the register since that time has been a diminishing quantity. I think it must be clear that there is a great deal more tonnage in the world now than is needed by the trade; but let us hope that the worst is over. We have gone through an extremely bad year. There is a saying in which I think there is a great deal of truth —that bad times are not infrequently fruitful in improvement. In fact, bad times seem to stimulate the genius of our engineers and shipbuilders, but I hope that pressure will not very often occur, because there is already sufficient stimulus to keep engineers up to the mark. Only the newest and most improved types of steamers can now be run at a profit. Old vessels cannot find employment, and it is doubtful whether a great number of them will not remain for the rest of their lives in port, unless they can be sold to foreigners, although, of course, in selling them to foreigners they are only so much added to the aggregate tonnage of the world, and they come into competition with our own vessels, especially when it is borne in mind that foreigners are able to run them at much less cost, and so to make them pay when we fail to do so. The experiences of the past year have been of a very mixed character—some highly satisfactory, some very much the reverse—but it is due from this institution that I should on your behalf congratulate the Admiralty upon the rapid approach to completion of the magnificent fleet which has been building since 1889. Every credit is due to the designer and to his staff, to the dockyard authorities, and last, though not least, to the Admiralty which proposed that programme, and most wisely arranged that it should be carried to a successful issue. I was delighted the other day in the House of Lords to hear the present First Lord of the Admiralty declare that the Board was prepared to go forward, and to pursue a continuous shipbuilding policy. I believe that the trials of many of the new vessels have exceeded the contract speeds, and this is not confined to the dockyard-built ships, but applies to some of our contract-built ships. That is very satisfactory, and it shows the wisdom of that policy which I always supported—namely, of giving as much employment as possible to our great private establishments. There is a rivalry between the dockyards and private yards, and it is most important to encourage the private establishments to keep up to the mark. Strikes and other difficulties sometimes delay the completion of ships, but I am proud of our private establishments. There is another matter of immense congratulation which I beg to offer



Edmiston's Feed Water Filters (*See page* 4).

to the Board of Admiralty. They seem on the way to overcome the very serious boiler difficulty, on which Mr. Durston is to read a paper with regard to cap ferrules, which appear likely to work out an antidote for leaking boilers, which at one time threatened to defy the efforts of our chief engineers to meet the difficulty under high pressure. Even out of evil good sometimes cometh, and though some of our fast ships have sustained accidents, which we all deeply deplore, examination has in one case given most encouraging results. I refer to the case of the *Apollo*, which struck on the Skerries at the close of the naval manœuvres, and I am glad to say that this accident proves my assertion—that in the whole range of scientific industry there is nothing which has made greater progress than the materials of which our ships are composed. No ship has ever been known to receive such injury to her hull and live to tell the tale. And what was the tale told by the *Apollo*? The length of the damage done to her hull was something like 100 ft., of which something like 60 ft. consisted of one great rent. The vessel struck upon three different rocks, but such was the toughness and the strength of the steel employed in her plates that they were in many cases bent upwards without breaking: but such was the elasticity of her frame, and particularly the connection between the two skins, that notwithstanding the tremendous amount of injury, her second skin was not penetrated, and I do not believe a single drop of water got into the ship. That is a proof not only of the admirable design of the ship, and the flexibility of her scantlings and framework, but of the splendid material of which the vessel was composed. Even now, after the length of time that has elapsed since the accident, another of our magnificent vessels is hanging between life and death as it were. But the latest accounts of the *Howe* show that there is a chance of saving her. But even this accident has its gratifying side It seems to me a little short of a marvel to hear that our chemists and engineers can so manipulate these awful explosives that they can actually blow the rock from the hull of the vessel without injuring the hull itself. To use such diabolical instruments—for such they are when misused—for the purpose of rescuing a vessel instead of destroying it, only shows that our engineers can do anything they like. The processes of invention and manipulation of these fearful explosives is so wonderful that we cannot put a limit to the possibilities. I have shown from these illustrations that there is even satisfaction to be found from those terrible catastrophes, which we all deplore. There is one more event which I must deal with, and that is the almost unparalleled incident of the repairs effected to the screw propeller of the *Umbria* in mid-Atlantic, and the conduct of the engine-room staff and the artificers in repairing that shaft under those circumstances. When you remember that there was a crowd of trembling and weeping emigrants or passengers utterly unused to the perils of the sea, when you remember the discipline maintained by the captain and crew, and unceasing exertions in the greatest difficulties of the engine-room staff to make the necessary repairs in a single shaft of that prodigious size, you must be convinced that the English sailor is what he always was, and still bears the high characteristic of courage under the most trying circumstances; that he is ready by his own resources and skill to meet any difficulties; and that our engineers equally show those characteristics. We must feel proud, as we hope ever to be, of the British sailor, wherever he may be. It would be wrong for me not to mention such an incident as this on the present occasion. I have said bad times are fertile of improvements. I will give one or two instances. There have been completed and sent to sea no less than four vessels of entirely different types during the past year; and each and all of these vessels possesses characteristics of an entirely novel character. Of course, the first of these is the *Campania*. In a drawing of this vessel there have been indicated alongside three craft which look like Yarmouth fishing-boats; but they are no other than representations to scale of the squadron in which, 400 years ago, Columbus discovered America. The *Santa Maria* was 300 tons, the *Pinta* 100 tons, and the *Nina* 50 tons. Compare those ships



EDMISTON'S FEED WATER FILTERS (*See page 4*).

with this new vessel. Here is, I believe, a vessel which is at present unparalleled. There is nothing equal to her in power and speed on the sea at the present time, except her sister ship the *Lucania*, which has been launched, I think. These vessels have a gross tonnage of 12,500, and a H.P. of from 28,000 to 30,000. There is a very peculiar characteristic about the sterns of these vessels. They have the "elliptic stern" and other features which entirely distinguish them very markedly from any other vessel ever sent to sea. But the extraordinary part of it is that in the magnificent establishment at Belfast there is a vessel building for the White Star Line which is expected to run 27 knots, with three screws, and H.P. of not less than 40,000 to 45,000. It is almost incredible, and it is expected that the voyage across the Atlantic, is to be performed in something like 4½ days if all expectations are fulfilled. It really looks as though we should soon be flying across the Atlantic, if this competition is to go on; and as though the great Atlantic, which not many years ago was the dread of navigators, is to be converted into a sort of experimental tank, to test the speeds of great ships which the various competing maritime nations are building. Let us wish these magnificent vessels all success, and no doubt we shall soon be able to get to America and back in a week's time. But I should think that before long the shareholders will begin to cry out. The next remarkable vessel is the *Yoshino* (for Japan), a very fast cruiser of quite a different character. Her great peculiarities are two. On her speed trials she can claim to be the fastest cruiser afloat at the present time. She did close upon 23 knots under forced draught, and she is a very heavily armed vessel indeed. The whole of her armament consists of quick-firing guns; and the concentration of her fire and her rapidity will render her a most dangerous enemy. Since, at the same great establishment of which I speak with great pride, Elswick, has been constructed the *Nuovo de Juilio*, for the Argentine Government. That vessel has achieved a marvellous degree of success in her trials. She ran 22·74 knots under forced draught, with an I.H.P. of 1,450; and she has a tonnage of 4,150 tons. At natural draught, showing a H.P. of 13,000, she did what no ship has yet done—21·9 knots. There are two other vessels now building, which promise to be larger, faster, and more powerful than the two vessels I have mentioned. I ventured the other night in the House of Lords to warn the Admiralty that the time had come when the British Government must have the fastest cruisers in the world; because we do not know in what obscure quarter of the world we may not meet with fast cruisers able to catch our ships, but able to escape from our war vessels. The Admiralty must keep their eyes fixed on the signs of the times. The next vessel I shall mention is perhaps the most remarkable yacht that has ever been built, certainly in this country—the *Valhalla*, which has been built for a gentleman I know. To begin with, it is of not less than 1,400 tons burden, and it has a sail area which you can only compare with one of the magnificent clippers of former days. It has a complement of 80 blue-jackets and 20 boys. It is armed with Armstrong guns, and its auxiliary steam power, which naturally is not very remarkable, enabled her to run at something like 10½ knots. On sail power only she ran at 11½ knots. This is a pleasure yacht built by a country gentleman, and it shows how we are advancing in yacht-building. The last vessel I will allude to is a ship of entirely novel construction—built on the Wear—a turret-decked steamer. Last year we discussed the whalebacks, and those vessels did not meet with much approval from the critics here. But this new vessel is a modification of the whaleback. She is a vessel with a deadweight capacity of 2,250 tons, and a draught of 18 ft. This is an entirely novel vessel, and her career will unquestionably be watched with interest by naval architects and engineers. Here are four vessels with most remarkable and entirely novel characteristics, which prove what I said as to bad times being fertile of invention. On Saturday last the Prince of Wales—ever foremost in promoting good work—made an announcement of great interest. We had a discussion, hardly long enough upon the steam lifeboat. So great has been the success of the steam lifeboat which was constructed two years ago that the same firm who built her have made an offer to the Lifeboat Institution to build a second boat, and to build it upon such terms as I think the institution will hardly hesitate to accept. The cost is to be one-third less than the cost of the original boat. That was £5,000, and the cost is now to be £3,250. I hope that the Lifeboat Institution will be in a position to accept so favourable an offer. I would now refer to a subject which must be of great interest to all of you—the rapid progress, and the success that is attending the great movement of technical education in this country Many of you being eminent shipbuilders and engineers must have watched with very great interest that movement. In connection with this very large and important subject, I was very much struck lately by reading some remarks delivered at Paisley by Mr. Caird. Mr. Caird laid down the axiom that the more a man knows of his work the more careful he would be about it. If I may make an addition to that axiom, I would say that the better the work, the more economical it will be in the long run. Mr. Caird has made a sort of estimate of the waste of material—the figures he gives frightens me, and so I will not quote them—in the whole of the mercantile marine due to inaccurate workmanship in the course of a year. He also adds the cost of additional coal required to propel that extra material through water. The cost of the coal alone is something like hundreds of thousands, and the cost of the bad work is estimated by millions. Mr. Caird points out that a very small proportionate sum—say, half the amount of the wasted coal expenditure used in propelling the extra material put into hulls to compensate for bad workmanship—would do very great things if applied to promote technical education. I have been practically connected with this question in my own part of the country, which is a great centre of the shipbuilding industry, and the efforts in the direction of technical education have been most successful there, and have been met in a liberal spirit by the County Councils. I recommend strongly that there should be a joint action between the County Councils and the different local institutions to promote the education of our workmen. Mr. Caird says that our system of technical education is deficient in two or three very important points. There are no facilities afforded at present to the adult workman to reach the different grades of work which he has to go through in the course of his vocation. From the labourer to the leading hand, from the leading hand to the foreman, from the foreman to the manager, each of these stages requires a special training, and the facilities for obtaining it are at present very inadequate. But it is extraordinary to hear a man of Mr. Caird's eminence and authority receiving the greatest applause from an audience of educational experts, laying still greater stress upon the deficient means of properly educating our apprentices. It is astonishing to hear these complaints coming from the banks of the Clyde, which have always been the centre of Scottish industry, and where engineering and shipbuilding have been carried on with unparalleled success for so many years. But it shows that a great deal remains to be done in the way of proper technical education. both for our adults and our workmen. The two most important years—from the leaving school to the entering on apprenticeship—are practically lost; that is a double loss. The young artisan is apt in these years to forget what he has learnt at the elementary school, and he does not learn anything else. Then Mr. Caird contends that at the age of apprenticeship (16 years) there is not care enough taken of the apprentices. They are left too much to their own resources. That is a matter which shipbuilders and engineers should attend to. Mr. Caird's greatest complaint is that the failure to get a proper training arises very much from the system under which work is now performed. A young man is penned down too closely to one branch or detail of the work on which he is employed. He may be an adept in one branch, but he is in absolute ignorance of almost every other part of the great machine which he helps to construct. I want to point out one or two things to prove that this subject is occupying the attention of men all over the country. The ideas started by Mr. Caird have been followed up by the President of the North of England Institute of Engineers and Shipowners, which is doing admirable work. It has introduced a graduate section, and the work of the young graduates showed the greatest promise. Mr. Fothergill, at West Hartlepool, pursued the same line of argument; and more recently Mr. Sage delivered an address at the Marine Engineers' Institute of the East of London, in which he pointed out the absolute necessity for every facility being given to workmen and their sons to obtain a sound and continuous system of training from grade to grade. But we have had another opinion, to which I attach immense value. The Duke of Devonshire—and all his opinions are based upon sagacity and common sense—said at Lancaster some little time ago that our system of education has hitherto borne too little relation to the occupations afterwards to be pursued. More recently, addressing the National Institution for the Promotion of Technical Education, the Duke of Devonshire said, "Utilise to the utmost the existing institutions." All we want is that the workmen should avail themselves of the existing institutions, and that the employers should stimulate their workmen to take advantage of them. We have such institutions in nearly all our chief ports. In Newcastle we have the North-East Coast Institution, closely

associated with the College of Science at Newcastle, which has established a Chair of Naval Architecture and Marine Engineering. The County Councils have, as I know from my personal experience, met these efforts on the most liberal terms possible, having regard to the limited means at their disposal. They are prepared to assist and promote a general system of training for the adult and younger workmen. I like to talk with workmen, because you get to know what their real opinions are; and to my astonishment I have often heard workmen speak of the "bugbear of foreign competition." No more delusive or stupid idea can enter into a workman's head. There are three or four nations who are striving their utmost to get level with us. No doubt we have earned laurels in the past, and have long held them, by the quality of our work. But it is absurd to suppose that those laurels will never be disputed. The Americans, within the last few months, have formed an association on lines almost identical with this, which will hold its first meeting in New York in May next. But more remarkable still, private American citizens during the last few years have given millions sterling to promote technical education in their great establishments; and they are wise enough, as I think, to protect those establishments. The Americans are now striving to create a navy, and to dispute with us the carrying trade of the world. An eminent shipbuilder, the President of our North-East Coast Institute, said in his opening address that he had been compelled to refuse a contract, and that it was accepted in Germany at a tender £1,000 less than the cost price calculated by his firm. It is idle to talk of foreign competition as a bugbear. Let our workmen avail themselves of the opportunities afforded to the utmost. They must not only keep up to their old standard; they must advance upon it if we are to hold our place as a great maritime Power of the world. I cannot help thinking that the effect of a good and sound training upon our workmen will be to teach them their own value. With greater knowledge they will be less likely to be led away by evil advisers. They will learn that their employers' and their own interests are mutual, and not antagonistic, and that conciliation is always better than conflict. We shall then be spared those heart-rending scenes involved by an extended strike. These miserable strikes would be on their last legs. As this is the last time I shall address you as President, I have thought it right to mention to you these points of public importance.

The report of the Council was then adopted.

The Jaseur.—The official eight hours' full-power natural-draught trial of the new first-class torpedo gunboat *Jaseur*, built and engined by the Naval Construction and Armaments Co., Barrow, took place at the mouth of the Thames on March 14th, under the superintendence of the officials of Sheerness Dockyard and the Medway Steam Reserve. The trial was attended with successful results, the engines working 220 revolutions per minute, and developing 2,545·8 H.P., with a mean speed of 18 knots. The *Jaseur* returned to Sheerness Harbour to prepare for her forced-draught trial.

WILSON & PIRRIE'S PATENT BOAT DISENGAGING GEAR.

THERE is probably no operation carried out on board ship which requires more promptness and certainty than the disengaging of a boat after she is slung clear of chocks and has been lowered the required distance, and, in the present day, when so much is being said and done in the way of life-saving apparatus, any new gear is at least worthy of consideration. The gear that we illustrate herewith is the patent of two gentlemen long known in Belfast and elsewhere in practical connection with shipbuilding, and their names alone should guarantee the efficiency of their patent. Fig. 1 shows the general arrangement of their gear, whilst Figs. 2, 3 and 4 show the details very clearly. A is the ring on the ends of the tackle falls by which the boat is suspended. B (Figs. 3 and 4) the wrought iron tumbling hook engaged. C, this hook in withdrawn position. D are shoulders, to ensure hook being withdrawn from the ring A. E is a self-acting tumbler, to enable ring of block to be shipped in place when the hook is in the engaged position. F is the bolt (which is carried down through the keel) by which the boat is hung, the upper end being connected by a pin to the tumbling hook and malleable cast-iron beam plate (this latter having various lugs on it for the tumbler, &c.) G is an adjustable connecting rod to actuate hooks. H are the cranks on the tube shaft which control the hooks. I tube shaft worked by the lever K. J are the bearings which carry the tube shaft and which are bolted to the keelson. From the foregoing description and from the illustrations the action of the gear is quite clear. Amongst the many advantages which this gear possesses, the fact that both hooks work positively (*i.e.*, it is not possible to let go one without the other) is certainly a very strong one. Again, so long as the boat is suspended high above the water, or just clear of the water, it has been so arranged that it is only just possible for a man pulling with all his strength at lever K to release the boat. Of course cases frequently occur in which it is of the utmost importance to be

Fig. 1.

able to release your boat before she is actually water-borne, or even partially borne, under which circumstances two men can readily accomplish this, but the moment the boat has reached the water the slightest touch releases her; still, should it not be considered desirable to release her, the hooks will hold until the lever is touched, even when the boat is water-borne. The moment the boat is released, the man who has done so, by bringing lever K into position again, leaves both hooks ready for the reception of the rings of the tackle falls, without further attention. This is certainly a most important point, especially when a boat has to be hooked in a heavy sea, for the man at one end may hook on all right, but the other man may miss at his end, which means that the boat would be hung up by one end, unless immediately released, and with this gear in an instant after release both hooks are ready for another chance of hooking on by putting lever K again into its former position.

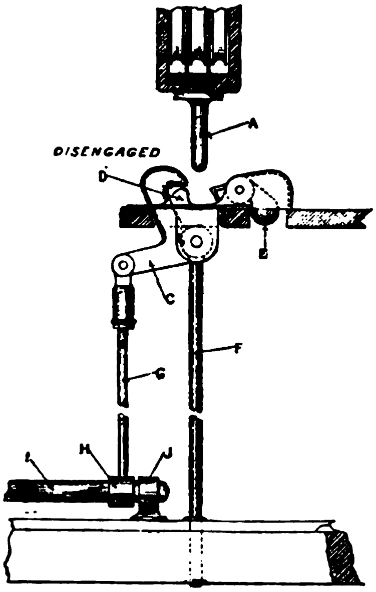


Fig. 2.

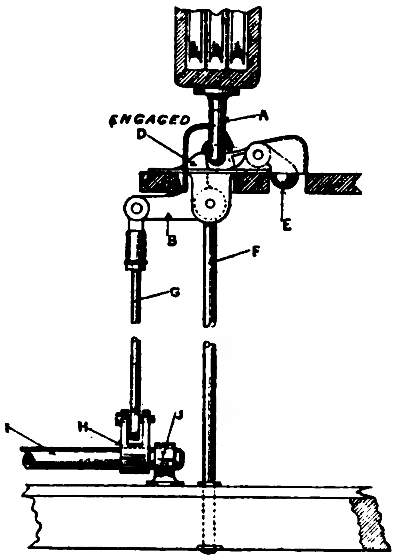


Fig. 3.

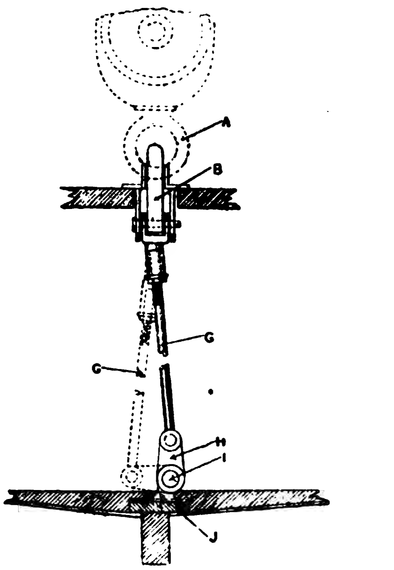


Fig. 4.

Messrs. Wilson & Pirrie hold that a perfect appliance of this kind is one which will give positive release to the boat even if she were full of luggage and passengers. Immediately after liberation the appliance should be instantly ready to connect to the davit falls. It should be of such a character that while the boat is being lowered, and is still clear of the water, it would be practically impossible for an ignorant or nervous person to release the boat until it is nearly afloat, but when afloat both ends should release at the same moment and with the least possible effort.

That Messrs. Wilson & Pirrie have succeeded in their gear is evidenced by the fact that it has been fitted to several boats of the first class companies, such boats as the s.s. *Nomadic*, s.s. *Tauric*, s.s. *Magnetic*, s.s. *Lancastrian*, s.s. *Philadelphian*, s.s. *Mahratta*, s.s. *Mohawk*, and s.s. *Mobile*. Messrs. John Hastie & Co., Greenock, are the licensed agents and manufacturers, and they have several other orders in hand showing that the gear is finding a good sale, an evidence of its practical efficiency.

THE BREAK-DOWN OF THE CUNARD STEAMSHIP "UMBRIA."

At the ordinary meeting of the Institution of CivilE ngineers, on Tuesday, the 14th March, Mr. Harrison Hayter, President, in the Chair, a Paper by Mr. Thomas Sopwith, M.Inst.C.E., was read, giving an account of the break-down of the Cunard Steamship *Umbria*, and of the steps taken on board to repair the damage.

Particulars of the voyage of the *Umbria*, and of the weather experienced during her passage from Liverpool to New York on the occasion in question, were given. She sailed from Liverpool on the 17th December, 1892, called at Queenstown on the following day, and, after encountering a violent storm, broke down on the 23rd December, when 760 miles east of New York.

At 5.30 p.m. on that day, one of the thrust-block shoes began to jump violently, probably owing to the action of a small piece of metal which had become detached from the fractured portion of the shaft. The engines were immediately stopped, and three or four of the thrust-block shoes were removed; when a serious fracture was discovered between Nos. 3 and 4 collars, at the end near the engine. The fracture extended round the shoulder of one collar for nearly the whole circumference of the shaft and then took a lateral direction to the other collar, following close against the shoulder of the latter for about 17 in. Thus, although greatly weakened, the shaft was not completely severed. The diameter of the shaft, which was steel, was 25 in.

Three slots were cut in the collars, which were 3½ in. thick and projected nearly 6 in. from the shaft. The slots were 4½ in. broad by 4⅞ in. deep, and the bolts were fitted into them and between the collars. The bulk of the metal was removed by drilling holes with a rachet-brace, and by afterwards chipping away with hammer and chisel that which remained. The labour required of the engineering staff was great, and was not only severe in its nature, but had to be done in a rolling ship, in confined space, and under a high temperature. During many hours a spell of 15 to 20 minutes was as long as a man could work continuously. Whilst that work was being carried out on the shaft, the preparation of the bolts was proceeded with; and for this, a vice, hammer and chisel were the only appliances available. It soon became apparent that the head and nut of each of the bolts would have to be reduced in thickness; because there was not sufficient clearance for them to pass the cast-iron ribs on the bed-plate which carries the thrust-blocks. This entailed much extra work, for the heads and nuts had to be bored through by numberless small holes, to separate the superfluous metal. The chief engineer was not disposed to destroy any portion of the permanent structure of the vessel, by smash-

ing away those portions of the ribs in the bed-plate which prevented him from putting in the bolts with heads and nuts of full strength. The repairs which carried the vessel into New York were shown in a full-sized model; they consisted essentially of a strong hoop over the fracture in the shaft, the bolts already described, and an outside hoop to keep the latter in their places.

Notwithstanding the great strain they had been subjected to, the engineering staff kept actively at work preparing duplicates of every part which might break; and if it should have become necessary to supplement the three bolts already mentioned by others, this course would have been adopted and the strength of the repairs would thereby have been considerably increased. It was impossible to determine the efficiency of the repairs on account of the unknown factor represented by the strength of the broken shaft, but it might be assumed that it was not more than 6 to 7 per cent. of the efficiency of a perfect shaft. The repairs were continued night and day from the evening of the 23rd December until the morning of the 27th. The vessel reached New York at 9 a.m. on the 31st December; her speed having been increased from 4 knots to 10 knots per hour, as confidence was gained in the efficiency of the repairs. Fortunately the weather after the completion of the repairs was fine, but the captain had a difficult task to get the ship into port, crowded, as that of New York always is, with vessels and ferries of all descriptions; for the engines, once started, had to go, and, once stopped, to stay, and anything like reversing could not have been safely attempted under the circumstances.

The discussion was adjourned until Tuesday, March 14th.

Sir Frederick Bramwell opened the discussion and urged that the shaft should be made in pieces of uniform length, so that damage might be the more readily repaired.

Mr. List (Castle Line) suggested that shafts should be made interchangeable, and that one spare thrust shaft should be carried.

Mr. W. H. White (Chief Constructor to the Admiralty), considered that the paper was of great value in many ways. The possible cause of this fracture was a question which ought to receive very close attention from steel makers. The shaft of the *Umbria* was made by a firm which, by common consent, stood in the forefront of manufacturers of shafting, and they might be sure that everything that could be done to secure soundness and perfection of manufacture was done. He hoped some representative of that firm would give some particulars of the manufacture of the shaft, which had done its work successfully for many years. The chief engineer of the *Umbria*, who under circumstances of peculiar difficulty carried through the temporary repair so successfully, deserved all that had been said, and much more than had been said of him. So long as we had in the care of the machinery of our steamers gentlemen of his courage and ability, aided by such a staff, we might be sure that that was one of the factors which would keep this country in the forefront of steam navigation. There was one great practical lesson growing out of this occurrence, and that was the great desirability in merchant steamers of high speed, carrying hundreds of human lives, of duplicating the machinery, shaft and propellers. Of course this was now an accepted principle. There was a gentleman who rushed into print immediately the *Umbria* accident happened, to suggest the use of twin-screws, as if he had discovered some novelty; but he was at once told that he was simply describing accomplished facts. They could not doubt that in the future the duplication of the machinery, of the boilers, and the shaft would become the rule; and it was possible, as speeds advanced, and as greater powers had to be developed with greater draught, that subdivision might go further still. That was going on in warships, and it might come to be carried out in merchant ships. It was now fully 15 years since he ventured to suggest, at the Institution of Naval Architects, that a practice which had been found of such immense advantage in the deep-draught ships of the Navy in using twin-screws would become of great importance in the mercantile marine. He was then treated as a visionary, and was practically told to stick to his last—that he might know something about warships, but that merchant ships were outside his beat. It was satisfactory, when one had ventured to prophecy, to find the prophecy realised; and it was still more satisfactory to know, as they now knew, that while securing the greater speed which duplication there was no loss of efficiency, but in many of efficiency. The use of twin-screws had now been in the swiftest torpedo-boats up to the grand w building, the *Campania* and the *Lucania* of the Cunard Line, which were about to begin their service. There were now in the Navy vessels of small size as compared with the *Umbria*, running up to speed of over 22 knots an hour, and the highest efficiency obtained in Admiralty practice in connection with steam-propellers had been achieved with twin-screws. When the power was sub-divided in that way, the moving parts of the engine were reduced; but the shaft itself was made of much more modest size in relation to the total power, and the work of the steel manufacturer was thereby made easier. There were several gentlemen present who could tell of the practical proofs that had already been given of the enormous gain in safety which resulted from the duplication of machinery.

Mr. Alfred Giles (Union Line) said the author of the paper advised travellers going long voyages to select boats which had twin screws, and as he had had some experience in a company which had recently taken to the use of twin screws he would like to say a word or two on the paper. The *Scot*, which was the largest and fastest steamship engaged in the African trade, met with an accident to one of her cylinders some time ago off Cape Ushant. The captain and the engineer completed the voyage with one engine, the only difference being that the speed was reduced from 17 knots to 15½ knots. Had the vessel had only a single screw she must have lain like a log on the water until she was towed back, and towing back was a very expensive process. The company were now building twin screws. The cost of working engines with duplicate screws was greater, but the additional safety secured was worth the little extra expense incurred. He thought that in the future there would be many more twin screws than there had been up to the present time; but the duplication of shafts would cost a great deal of money. There was one matter which deserved the attention of shipbuilders and engineers generally, and that was the question of reducing the length of shafts by putting the engines further aft. Many accidents were attributable to the length of the shafts, and although there was some little difficulty about the trim of the ship, he thought that might be surmounted.

Mr. Frank Hall (Sheffield) confessed that no one was more pleased than himself when the accident happened to the *Umbria* thrust block, although of course he was glad that no loss of life resulted. He was glad because the accident confirmed what he said in the paper which he read before the Institution of Naval Architects in 1886 on "Flexible crank propeller shafts in lieu of rigid propeller shafts for marine propulsion"—that, however good they might make the steel, and however strong the shafts might be made, it was not fair to the steel or to the shafts to make them support the ship. When a ship bent in the sea a long rigid shaft could not bear the strain, and therefore the shaft ought to be made with a flexible coupling near the engines. With twin screws the dangers were obviated to a very great extent, and as most shipbuilders and shipowners would object to the shaft being shortened, the best way of getting over the remaining difficulty was to make the shaft flexible in the way he proposed.

Mr. Thornycroft said the last speaker had fallen into a popular error on this subject. There was a belief that a ship would bend, and that a shaft would not bend, but the stiffness of the structure depended rather on the relative length and depth. If the ship was properly built, it could not bend to any extent that would distress the shaft. What the last speaker had said was therefore an entire mistake, and he hoped they would not hear that view again in the institution. The accident to the *Umbria* showed what a small power would drive a ship. One cause of shafts breaking was not sufficiently considered, and he protested against using the full power of the engines on a screw shaft to go astern.

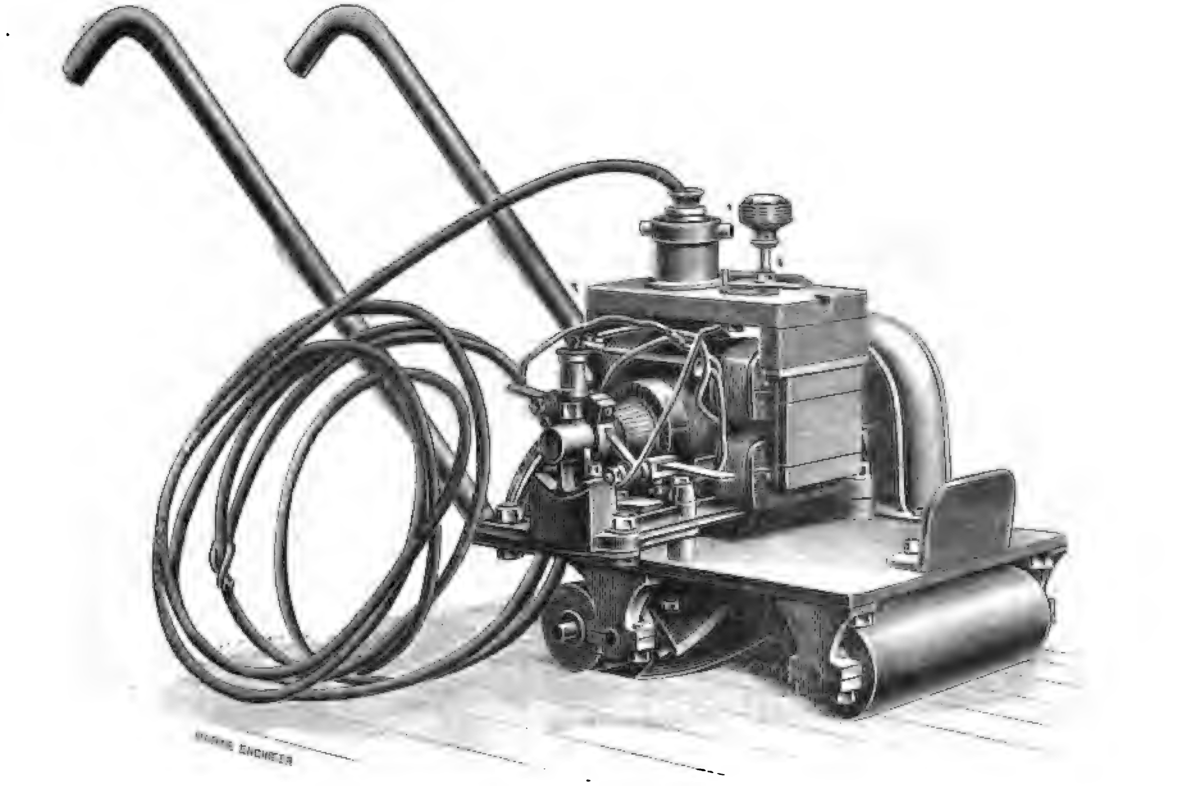
Lord Brassey heartily subscribed to the deduction of the writer of the paper, namely, that if one contemplated a sea voyage, it was wisdom to select a vessel with twin-screws, if a twin-screw was available; and on behalf of the general public he desired to express a warm tribute of praise to the gallant engineer of the *Umbria* (Mr. Tomlinson), who, in circumstances of such extreme difficulty, effected a sufficient repair to carry the vessel into port. What was now on record and before the public was not rarely repeated in the engine-rooms of ships, but we were only imperfectly informed of the gallant deeds which were done by engineers in carrying out their duties. In the first instance, shipowners were deterred in the adoption of twin-screws by considerations of expense. Another difficulty which was apprehended in connection with twin-screws was that injury might occur to the propeller when going alongside a dock wall, and a third difficulty was that of navigating twin-screw steamers

through the Suez Canal. As one of the directors of the Suez Canal, he heard a good deal from the less experienced pilots in the service of the Suez Canal Co. with reference to their anxieties in carrying twin-screws through the Canal, but no doubt that was a difficulty which might be overcome. If we contemplated the construction of vessels of the great size which had already been reached, and which did not by any means express the final term in consideration of size, it had become absolutely necessary to adopt twin-screws in order to handle such vessels effectually, more particularly in the operations of docking, in which such screws were of immense service.

Mr. Sopwith replied to the discussion, and was warmly thanked for his paper, which described an occurrence of which he happened to be an eye-witness.

A NEW ELECTRIC TOOL.

THE use of electricity for transmitting power has been steadily increasing during the last few years. Not only is it often found better than mechanical transmission, but in many cases it enables mechanical power to be applied to work, where, without electricity it would be quite impracticable to use anything but hand power. One of the latest machines of the latter kind is an electric deck planer, invented and patented by Mr. Malcolm Sutherland, electrical engineer to Messrs. William Denny & Bros., the well-known shipbuilders of Dumbarton.



Our illustration shows one made by that firm, and used by them for planing the decks of the ships they build. It is so simple in construction that very little explanation is necessary. It resembles a lawn mower in form, and is handled in the same way, and with as much ease. A steel base plate is mounted on rollers, and on the underside of this the revolving cutter is fixed. The electric motor is placed on top, and is geared to the cutter by means of toothed wheels. The latter is one of Rawlin's spiral cutters, and revolves at a speed of 3,000 revolutions per minute, the motor having a speed of 2,000 per minute. The hind rollers which follow in the cut are fitted with eccentric journals, so that by moving a lever they can be raised or lowered, and the depth of cut nicely adjusted. It does very good work, is faster than hand planing, and relieves the men of a very disagreeable job, as the planing of decks by hand involves kneeling or sitting in a very uncomfortable position. Current is supplied to the motor by means of a twin flexible lead, and the whole machine is of a very compact and portable nature.

HULL AND DISTRICT INSTITUTION OF ENGINEERS AND NAVAL ARCHITECTS.

ON Monday evening, March 13th, the members of the above Institution held their usual monthly meeting at the Institution Rooms, Bond Street, the lecturer for the evening being A. H. Bate, Esq., A.I.E.E. (of Messrs. Edison & Swan, Limited), the title of his paper being, "Some Notes on the Electric Lighting of Ships."

At the commencement of his paper, the lecturer reverted to the time when (thirteen years ago) Mr. Swan and Mr. Edison invented the incandescent lamp. Then, probably, no sober-minded man would have believed that in a single decade that tiny toy, shown occasionally at popular lectures, would become an important article of commerce, and create an industry more vital to our civilized life than the telegraph or telephone.

That the cool healthy light of the incandescent lamp met with such a favourable reception shows that it supplied a public want; but in the early days there were serious defects, the lamps flickering and breaking, and too often the machinery broke down and the lights were extinguished.

One by one, however, the difficulties have been overcome, and improvements made, till now the uncertainty which at one time threatened the electric light with public disfavour, is almost unknown.

Mr. Bate stated that there are few electric light installations which can be carried out under such favourable conditions as obtain on shipboard.

There is no objection to noise and vibration, the lights are all near the dynamo and do not require great lengths of expensive copper wire, &c. (as on shore), and, above all, the steam-power is already at hand and can be used without any sensible difference in the coal bill. The power required for the electric light plant, in comparison with the usual steam-power, being only about ½ per cent. in first-class boats and not more than 1 per cent. of the I.H.P. for ocean liners.

The different classes of engines and dynamos were dealt with, the lecturer advising that dynamos of a standard pattern by some large maker should be used, so that, in case of a breakdown of the armature, a new one could be supplied at once from stock, whilst the steamer is in port; he also advised that the dynamos should be "compound wound"—that is, so made that if part of the lamps be switched off, the remainder, if the engine is properly governed (and the best of governors should always be used), would not burn more brightly, or get overheated, and so practically spoilt.

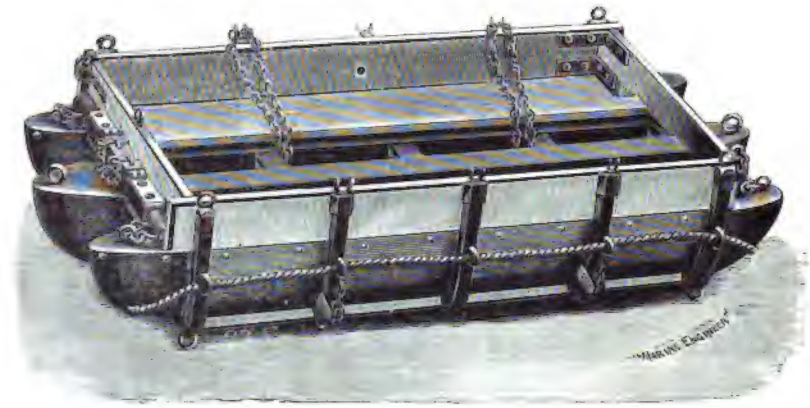
Mr. Bate then dealt in a most comprehensive manner with the best methods of grouping lamps on the different mains, according to their uses, the switch-board attachments, fuses, cut outs, the best forms of wiring (both the single and double wire system being explained), insulating materials and sheathings, joints, the most economical and suitable voltage at which to run the lamps, the construction of the various lamps, fittings, &c., &c., and also explained a simple and effective device for finding and locating any leak or defect in the insulation. The lecture was illustrated by diagrams and samples of lamps, switches, cut outs, &c., &c., chief among the exhibits being one of the new electric miners' lamps, charged and working, and a voltmeter or electrical pressure gauge. Owing to the length of the lecture only a short discussion followed, at the close of which a very hearty vote of thanks was accorded Mr. Bate for his valuable paper, which was suitably acknowledged, and the meeting terminated.

T. S. M'Innes & Co.—Owing to the death, in February, of Mr. Thomas S. M'Innes, sole partner in the above firm, their business, as Engineering Instrument Makers, will be in the future carried on by Messrs. Alexander Dobbie & Sons, opticians, Glasgow. The old name of the firm, however, will be ... in the meantime. Messrs. T. S. M'Innes & Co. are ...akers of M'Innes' patent indicators, engine counters, ...ir present address is 86, York Street, Glasgow.

PARRATT'S DECK-SEAT SAFETY RAFT.

ALTHOUGH a good number of devices have been introduced from time to time with the object of providing safety rafts or lifeboats easy of transport and manipulation, very few of them have possessed sufficiently distinctive merits to recommend them to the notice of shipowners.

The invention which we now illustrate consists of three copper pontoons which serve as deck seats when separate. The centre pontoon has folding gratings on each side, and is fitted as a lifeboat with self-relieving valves. There are lockers for provisions and distress signals, and a water tank under the flooring. The raft is completed by fixing the gratings in a horizontal position, and then the side deck seats are clamped underneath. Rowlocks are fixed on the wash boards. The pontoons are all on castors, and therefore the raft is ready in two minutes for launching. The conspicuous advantage of this arrangement is that the raft can be stowed away in a comparatively small space, and when the parts are in use as deck seats they are no encumbrance to the vessel. The raft can be launched in any weather with one rope attached if the ordinary davits are otherwise engaged, and will accommodate a larger number of persons than an ordinary boat of the same dimensions.



Messrs. Holzapfel's Composition Co., Limited, have sent us a large tabulated list of the dry docks, pontoons and slipways of the world, giving the greatest length, width and depth on sill of the largest dock in each place, together with approximate prices per ton gross register of the cost of docking, cleaning and painting vessels in each of the ports. This will no doubt be very useful information for shipowners, captains, &c. Messrs. Holzapfel are willing, on application, to send copies post-free to any shipowner at home and abroad requiring them.

Alexandre-Petion.—There was recently launched from the yard of the Forges et Chantiers de la Mediteranneé at Havre the gunboat *Alexandre-Petion*, built for the Haytian Government. The vessel is 147ft. long, 20ft. beam, with a draught of 6ft. 6in. The armament will comprise one 10 cm. gun, and four 37mm. rapid-firing guns.

The new Off Shore Dock, Clarke Standfield's patent, which was opened in January this year, has since been in constant use, and works most satisfactorily.

ANTI-RUST COMPOSITION.

THE question of what material to use for the coating of bright parts of machinery, to prevent corrosive action by atmospheric and other causes, is one that is much before marine engineers. The essential qualities of such a material should be, that its cost per unit of area covered be reasonably low, that it can be put on and removed with ease, that it shall absolutely prevent the action of external corrosive influences on the metal, and that its composition shall be such as not to change upon contact or communication with any ordinary substances, such as the metals it is to protect, or sea water, steam, atmospheric air, and other similar substances that may be likely to come into contact with the protecting medium.

Many kinds of grease that have been used for this purpose, have the great disadvantage that they either contain free acid, or that within a very short time they absorb acids from the atmosphere, and on this account very quickly become rancid, and consequently have to be removed and substituted by a new coat. It is a matter of common knowledge that a thick layer of rust is often found under a quite fresh-looking covering of tallow and whitelead, which has been caused by the air penetrating through the pores of the mixture, setting up a chemical action upon the surface of the metal.

Moreover, it is well known that many kinds of grease leave spots on the surface of the metal, giving it a mottled and undesirable appearance, which are very difficult to remove. Substances such as paint or varnish are often used to get over the difficulties, but the labour and expense entailed in removing it when desired is considerable, as a solvent such as turpentine or petroleum has to be used, and much time is involved in the operation.

We understand that all these drawbacks and difficulties are entirely overcome by using a new anti-rust preservation composition named "Mannocitin." It is claimed that this composition contains no acids whatever and does not absorb any acid from the atmosphere, hence it does not turn rancid and further it can be easily removed. It absolutely resists the corrosive influence of the atmosphere, as well as that of salt water and the vapours of ammonia and muriatic acid; it never becomes hard, but always remains slightly sticky. It will stand a moderate amount of heat and the bright parts of a boiler may be covered with it whilst in use, without the heat causing it to run off, at the same time it will not stand a very high temperature, such as would exist in part in direct contact with, or in close proximity to the fire. Its covering capacity we should think is considerable, as we understand that 2 lbs. of composition will cover 34 square yards. It is being used on the continent in large quantities, and judging from the testimonials of users which we have seen, is giving very great satisfaction. An important feature of the composition is that it is transparent, and thus is very applicable for the coating of propeller shafts, which can be readily examined and submitted to close inspection without necessitating the removal of the preservative coating.

It is being put upon the English market by Messrs. C. F. Otto, Muller & Co., of 70, Gracechurch Street, London, E.C., who are the sole agents for this composition in the United Kingdom.

THE NEW DEVELOPMENT AT SOUTHAMPTON.

IN our editorial last month we foreshadowed the change which has come over the destinies of Southampton, and during the present month we have seen the inauguration of the new line of steamers from New York to that port. Southampton is very jubilant at the acquisition of the American line, and perhaps not without reason. But it is now finding that its immediate gain is not much. The coming of the *New York* excited the wildest enthusiasm at the port, and that enthusiasm has in some quarters caused laughter amongst the knowing ones. If the advent of the *New York* as a single ship, or even as the representative of the fleet which has just passed from under the old Inman and International flag to that of the American line, had aroused Southampton to the pitch which was maintained throughout the week the vessel was in port, then we should say the reception was, indeed, ridiculous. But we take it that the London and South-Western Railway Co., who are at the back of the whole business, looked much further and deeper. The reception accorded to the *New York* was in part accorded to her because the British wished to show that they bore no ill-feeling on account of the change of flag, in part because she represented the first of a fleet of steamers which has left Liverpool for Southampton, but chiefly because they believed that her advent was the sign that a new era had dawned for the Southampton docks. That new era, if it benefits the docks, cannot fail to benefit the railway which owns and feeds them—it cannot fail to benefit the town which finds the labour to work them.

The transfer of the Inman fleet is, in itself, but a slight blow to Liverpool as regards the tonnage of its port. The 30,000 tons of shipping comprised in the fleet may help Southampton; it cannot injure Liverpool's totals. The two new Cunarders, *Campania* and *Lucania*, will total up a gross tonnage not far short of that now taken away. The four ships of the Bibby line which have recently been added to the Eastern passenger trade are also almost enough to make up the deficiency, whilst the fleet of White Star cargo boats on the North Atlantic Station more than fills the void. If it were a question of tonnage merely Liverpool could spare—and in present times be glad to get rid of—enough tonnage to start Milford and the new port in the Bristol Channel as well. The blow to Liverpool is a blow to her prestige, and that is not easily recovered. As one of the local speakers at the Mayoral banquet at Southampton said, "Liverpool has been tried and found wanting." We do not think this is altogether accurate. To those who have followed the course of events during the last few years, especially during the last few months, it is apparent that the private affairs of the high contracting parties and their connections on both sides of the Atlantic have had a good deal to do with the bringing about of the new alliance. But the fact remains that the popular mind, as represented by the Press, by the Southampton people, and perhaps by the travelling public, takes the view that the route viâ Liverpool is inferior to that viâ Southampton, and in these cases the fact of such an impression getting abroad tends to divert the trade into the new channel.

Southampton seems a little disappointed, now it has got the line, to find that there are only four vessels, and that two of these are "not of the most modern type." It comforts itself, however, with reflection that the new vessels now building at Philadelphia will soon be on the route, and will strive with the new Cunarders for the supremacy in speed. Here, however, a very important matter has to be noticed. The *Campania* and the *Lucania* are already in the water. In three weeks the former may be at work. The keels of Cramp's cracks are only being laid down now, and Philadelphia advices report that the first will only be ready for launching in two years. The wheels of American shipbuilding grind noisily, but they grind exceeding slow. We hear a great deal about what these vessels will do, and how in every way they will show the old country the way how ocean greyhounds can be turned out; but it must be borne in mind that it is possible for the two new Cunarders to come out in the

present spring, spend a season on the Atlantic and show their paces, for Harland & Wolff to observe their advantages and defects, and to turn out the much talked of *Gigantic* and her unnamed sister from plans corrected by Cunard's experience, and have these vessels ready by the time the new United States mail steamers are in the arena. Fairfield has built these great Cunarders in a brief space, and thereby has gained many advantages. The original plan has not been varied. The vessels are thoroughly up to date, and are in size and power what they were intended to be—in advance of anything afloat or approaching completion. For at least three years they must be unrivalled on the Atlantic. As we have shown, the Philadelphia boats may be deprived of this advantage even if they excel the Cunarders. And to our readers it is unnecessary to dwell on one point, though it be one of the first importance. Speed of production means economy in building. This point cannot be ignored in a keen and costly competition such as the present. We are on the eve of exciting events. Not only are the ports of Liverpool and Southampton on their mettle, but the German and American builder and owner are anxious to deprive us of our position at the head of the Atlantic passenger trade.

After this reference to the bearings of the celebration at Southampton, we may briefly give some account of what took place at that port. The *New York* left Sandy Hook at 3.42 p.m. on the 25th February, under the command of Captain Jamieson. On the previous Wednesday she had changed her name and nationality, the ceremony of hoisting the American flag being performed by the President of the United States himself. She brought a few passengers only compared with what she carries in the height of the passenger season. There were 140 saloon, 40 second-class, and 70 steerage passengers, and 895 bags of mails. She passed the Lizard unnoticed, but was signalled off Prawle Point at 1.23 p.m., and passed Hurst Castle at 6.20 p.m. on the 4th March, making the passage in 6 days, 21 hours, 38 minutes—a good performance for the time of year, but not the best on the route by several hours. Off Hurst Castle she was met by the London and South-Western Railway Co.'s paddle-steamer *Wolf*, with the Mayor and Corporation, as well as a number of important residents and shipping people. Unfortunately by the time she came up it was quite dark, and the effect of the reception was thereby a good deal marred. For, strange to say, the *Wolf's* bunting went up as the sun went down; but the warmth of welcome displayed made up for everything else. She was greeted with cheers from the crowd, and "Hail, Columbia!" from the band, and then passed on to the Empress dock. The arrival gave Southampton a chance of showing the truth of its pretensions. The evening was calm and fine indeed, but it was dark and though the tide was making, it was only an hour from low water. Yet as soon as the tugs got her she went into the dock, and was safely placed in the berth prepared for her. There was more difficulty, apparently, in getting the *Wolf* into the old dock than in berthing the big liner in the new. Alongside the *New York* was a commodious shed, and here the special, composed of carriages as already described, was waiting for the saloon passengers. Their baggage was brought out of the ship into the shed, there examined by the Customs, and taken on to the train. The system worked admirably, though, of course it was not severely tested by a small passenger list such as she had. The whole of the mails meanwhile were landed, checked, and dispatched at 10.10 p.m., in a special of their own, an hour and twenty minutes after the gangway was put across to the dock wall. Thus the South-Western Co. showed its mettle. The journey from dock to terminus station and stoppage there occupied a quarter of an hour, and then the 78 miles to Waterloo was covered in 85 minutes—a very fine performance. Shortly afterwards the saloon special followed, and the lower grades of passengers were sent on later.

The reception was, however, only commenced. On the Monday night the crew were entertained in the St. Mary's Road Drill Hall by the local volunteers. The plan was, perhaps, appropriate to the occasion, for it was part of the Liverpool Exhibition building removed to a new site. On Tuesday there was a luncheon on board the *New York*, where the owners entertained the shipping and business people of Southampton, as well as the railway and municipal authorities and a large number of Press men. The American Minister was present and Sir Donald Currie, and there was much congratulation on the revival of the Stars and Stripes in the Atlantic passenger trade. There had been some little difficulty with firemen and stewards, and upwards of a hundred of the *New York's* crew returned to Liverpool and were replaced by local men. Nevertheless the luncheon passed off excellently, though the great saloon was filled with guests. On Wednesday the ship was thrown open to the public, and several thousand people availed themselves of the opportunity of inspecting her at a shilling a head. The local charities, on whose behalf the charge was made, thereby benefited substantially. On Thursday the officers dined at a local club, and on Friday night the Mayor gave a banquet, at which 150 covers were laid and speeches of a congratulatory nature again indulged in.

On Saturday, the 11th, the *New York* was appointed to sail at noon, it being now arranged that noon on Saturday is the line's fixed sailing hour, a saloon special being also timed to leave Waterloo Station at 9.40 a.m. in connection. The special started from London to time, and reached Southampton in due course; but mails and passengers were kept till 1 o'clock in consequence of the lateness of a Great Northern special bringing 60 Scandinavian emigrants from Hull. This is a bungle not likely to occur again, and, after all, the delay was not very serious. The *New York* lay with her head towards the dock entrance. The last gangway was removed, a tug drew her bows away from the dock wall and pointed them for the opening, and she began slowly to pass out of the dock. The operation lasted barely half an hour, and at about 20 past 1 the first westward voyage of the American line was commenced amongst the most enthusiastic cheers of the good people of Southampton who lined the dock-head in their thousands to wish her success.

LAUNCH OF A REMARKABLE DREDGER AT BARROW.

On March 4th there was launched by the Naval Construction and Armaments Co. from their shipbuilding yard at Barrow-in-Furness, a twin-screw hopper and sand-pump dredger, named the *Brancker*. This vessel was built to the order of the Mersey Dock and Harbour Board, who have been so satisfied with the experiments made in cutting a channel through the Mersey bar, that they have determined, in the most enterprising manner, to further proceed with dredging operations there, so that steamers of the largest tonnage may be enabled to enter the river in any state of the tide. The vessel and her apparatus being of a novel type and intended for operations which are to be conducted on such a gigantic scale, the designs have required great consideration, and have necessitated a long series of trials being undertaken, to determine the best methods to be adopted in construction.

The vessel has been designed by Mr. A. G. Lyster, under the direction of Mr. G. Fosbery Lyster, engineer of the board.

The following is a general description of the vessel:—Length between perpendiculars, 320 ft.; breadth, moulded, 46 ft. 10 in.; depth, moulded, 20 ft. 6 in.; gross register tonnage, 2,560 tons. She is built of steel to Lloyd's highest class, and has amidships eight large hoppers, four on each side of the vessel, having a total capacity of 3,000 tons of sand. These are fitted with Mr. A. G. Lyster's patent hydraulic discharging apparatus. A well is formed up the centre of the ship between the hoppers to admit of the working of the sand-pump suction tube 3 ft. 9 in. diameter through the bottom of the vessel. This tube is raised and lowered by hydraulic power, and when lowered can dredge to the depth of 45 ft. Large rectangular landers are fitted above the hoppers, with openings over each compartment to allow of spoil being distributed in hoppers as required. There are two large centrifugal pumps having suction and discharge pipes 3 ft. in diameter, capable of raising 4,000 tons of sand per hour, and driven by two sets of triple-expansion engines having cylinders 11½ in., 18 in., and 29 in. diameter by 18 in. stroke, and which work at 160 lbs. pressure, and these are placed in a pump-room below the main deck, immediately forward of the hoppers; while on the main deck immediately over the pump-room is built a house containing the controlling gear for pumps, &c. Comfortable accommodation is provided under the poop for the captain, officers, and engineers, including state rooms, saloons for superintendent, and also officers' saloon, the crew and firemen being berthed forward under the main deck. The vessel has also two cargo-holds, being each worked by a powerful steam-winch. A steam-windlass is fitted on the forecastle deck for working the anchors, which are of the stockless pattern. Two rudders are fitted, one forward and one aft, controlled by steam

steering gear placed in house on bridge. The vessel will be propelled by twin-screw inverted triple-expansion engines; diameter of cylinders, 18 in., 29 in., and 47 in., and length of stroke 30 in., which will be supplied with steam at a pressure of 160 lbs. from two single-ended boilers, each 10 ft. 6 in. long by 14 ft. 9 in. diameter. These boilers are supplying the steam for pumping-engines. Amongst those present at the launch were Mr. G. B. Crow (Chairman of the Mersey Dock and Harbour Board); Miss Crow (who gracefully performed the christening ceremony); Mr. J. H. Morgan (Mechanical Engineer to the Mersey Dock and Harbour Board); the Mayoress of Barrow, Mr. J. E. H. Clarke, Mr. Ratcliffe, Captain and Mrs. Barton, Mr. Lansdowne, Mrs. Hamilton, Miss Taylor, Miss Carmichael, Mrs. Blechynden, Miss Blechynden, Mrs. Gowan, Mr. F. F. Hill, Mr. A. F. Kingsnorth, R.N., Mr. Arthur Bellhouse, Dr. Daniel, Mr. Johnson (Lloyd's), Mr. Dean (Admiralty), Captain Daniels, Mr. Griffin, Rev. Mr. Stirrup, Mr. A. Adamson (Managing Director of the Naval Construction and Armaments Co.), Mr. Blechynden (Engine Works Manager), Mr. Gowan (Shipyard Manager), and others.

At a subsequent luncheon, Mr. Adamson said he could not allow the party to separate without drinking success to the ship they had just put into the water. The *Branckner* was named after the chairman of the Mersey Board, and he was sorry that gentleman was not able to be present with them that day, but they had a very able substitute in Mr. Crow. This dredger was the largest that had yet been built, in fact it was the largest dredger in the world, so far as he knew. They would understand this to be a fact, when he mentioned that the dimensions of the vessel were 320 ft. in length, 46 ft. beam, and that she could lift 4,000 tons of material from the bottom of the Mersey in one hour. She was built to carry 3,000 tons, and she could therefore fill herself in about three-quarters of an hour. The vessel was intended for the deepening of the Mersey bar, and the dock Board had devoted considerable time and attention to this matter, and had made satisfactory progress with the work they had done in the past. They now hoped the *Branckner* would be able to complete the removal of this great obstruction to the navigation of the Mersey, so that vessels of the largest size could enter the river at any state of the tide. He proposed success to the *Branckner*, coupled with the name of Mr. Crow, Chairman of the Marine Committee of the Mersey Board.

Mr. Crow said he was obliged to Mr. Adamson for coupling his name with the toast. He was sorry the chairman of the Mersey Board was not present that day to recognise their kindness in drinking this toast, but as the next oldest member of the Board, and as chairman of the committee who had charge of this special work which this vessel was built for, he had pleasure in responding. The vessel was intended to perform a very important work for the port of Liverpool, and also a great work for the neighbouring ports. The Mersey Board may be said to be charged with a national trust. It was not carried on as some people might think, for private profit or private enterprise. Certain members were elected to the Board from the ratepayers—not the ratepayers of the city, but the ratepayers who exported and imported goods. Then a certain number of members were appointed by the Government, thus recognising the work entrusted to the Board as a national one. They hoped when this vessel was completed that they would be able to deepen the bar which had been an obstruction to the navigation of the Mersey for all time, and which doubtless would have continued for ever if it had not been for new discoveries in science. Work which ought to have been done by the Mersey Board years ago, but which possibly could not have been done by the old type of dredgers, could now be completed by means of dredgers of the type which had been launched at Barrow that day. It had been found that they could pump up sand to such an enormous extent by means of these vessels, that it was determined to apply them to the work of removing the bar. They began this work about two years ago, with two dredgers capable of lifting about 400 to 500 tons of sand per hour. They proceeded with the work for some time, feeling that it was to some extent experimental, and knowing they would be compelled to go in some day for much larger plant. The experiment, he was glad to say, had been so far successful, and they had now deepened the bar from 10 ft., its original depth, to 18 ft., and it was very satisfactory to find that the new depth remained permanent. During three and four weeks, when storms were experienced, and the dredgers could not work, the depth attained on the bar was maintained not by the dredgers, but by the increased facilities afforded to the ebb and flow of the tides which swept the sand away and kept it clear. The dredgers the Board had now were not capable of going much deeper, and for that reason the Board were anxious to get the *Branckner* to work. He felt quite sure this vessel would enable the Board to deepen the bar 24 ft. to 25ft., and thus open the river to the largest class of ships at any state of the tide. He hoped that his belief in the success of the dredger would be fulfilled, and that that order would be followed by another one. This was a new departure, not only in the style of the dredger, but in the way in which it was to be worked. In construction it was a new departure from what they had had before. A great deal now depended on the success of the scheme which had been adopted in this ship, but he felt pretty certain success would be the result. He specially complimented Mr. Blechynden, the engineer of the Barrow company, for the manner in which the engineering work of the ship had been carried out, and he could say as the representative of the Mersey Board present that day, that they all looked forward with the greatest confidence to the time when the vessel would begin her work.

Mr. Adamson then proposed the health of Miss Crow, who had performed the launching ceremony that day. He hoped this was a happy augury to the success of the *Branckner*. He had pleasure, on behalf of his company, in presenting her with a souvenir of the occasion—a beautifully enamelled silver card-case, suitably engraved.

Miss Crow briefly returned thanks for the kind way in which her health had been proposed and received, and said the handsome souvenir with which she had been presented would always remind her of the pleasant day she had spent in Barrow.

Mr. Crow also briefly acknowledged his own thanks for the beautiful present made to his daughter.

The Chairman then proposed the health of the Mersey Dock Board. The Naval Construction and Armaments Co. were very much indebted to them in carrying out the details of the vessel. Mr. Blechynden, as Mr. Crow had said, would have the heavy end of the business, as the building of the ship was a very simple matter; but in a dredger like this the engineers had most complicated arrangements to carry out. To Mr. Lyster, the engineer of the Board, and also to his son, who had had the more immediate superintendence of the plans and the work, especial credit was due. In fact, the method of discharging into the hoppers was a patent of Mr. Lyster, junr. He wished to couple this toast with the name of Mr. Morgan, with whom they had been brought into immediate contact during the progress of the work of building this vessel, and they had almost come to look upon him as a Barrovian. He submitted to them the toast of the engineers of the Mersey Dock Board.

Mr. Morgan said he was very much obliged to them for the manner in which they had spoken of him. He believed the credit for this work was more due to Mr. Blechynden and the officers of the Naval Construction and Armaments Co. than to the officers of the Mersey Dock Board. He felt sure that the care and trouble which had been exercised in the construction of this vessel would guarantee her success when she came on her trials. Every detail had been carefully considered—strength of parts, &c.—in order to enable the vessel to do the work she would have to do in an exposed place and strong gales blowing. He concluded by proposing the health of Mr. Blechynden, to whom thanks were due for the way in which he carried on the work of his department.

Mr. Blechynden said he had to thank them heartily for associating his name with the toast. So far as his part in the vessel was concerned, he was merely acting to a very large extent under the direction of the Mersey Board, whose the dredger must really be, and to whom must the credit fall if it be a success, and he had every reason to believe it would be a success.

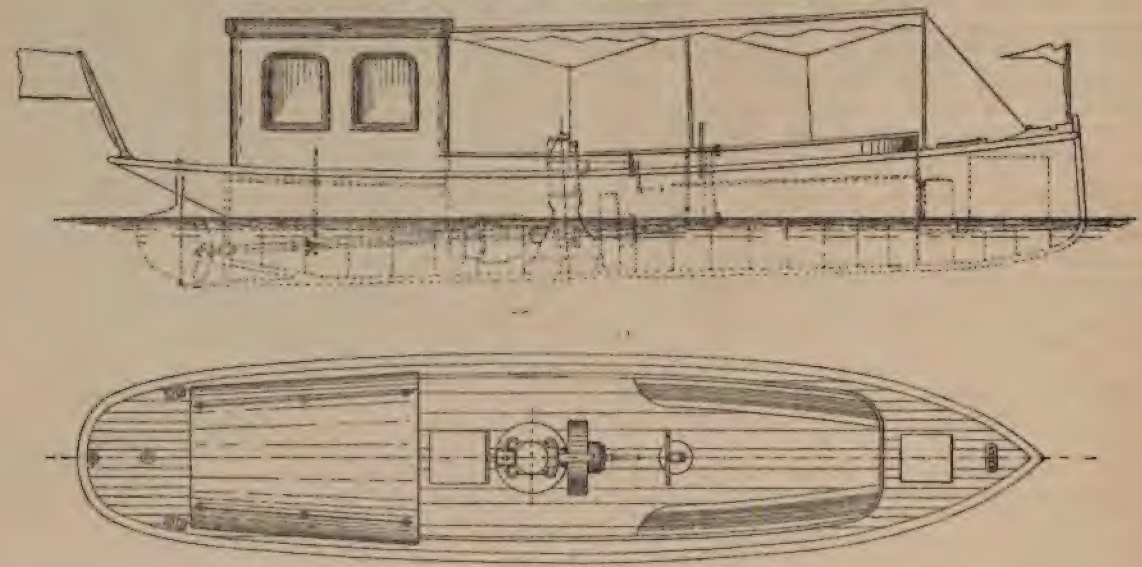
Mr. J. E. H. Clarke said he had just been asked to propose a toast which he had no doubt everybody would receive with the utmost cordiality—that of the Naval Construction and Armaments Co. This company was one in which not only the people of Barrow but the district at large looked upon with the greatest pride, and felt proud of the great results which had been achieved by it. He was quite certain there was a great future for the company. The firm which he represented had for a number of years been connected with the company in business transactions, and they had always been of the most pleasant nature. He would just like to say one word with regard to an article which had been noticed in the *Barrow News* of that day, copied from *Fairplay*, with reference to this company. They all looked upon it as a joke, but still he thought it was only right

and proper that such notice should be taken of it as in the local paper that morning, in order to repudiate such a ridiculous rumour. He proposed prosperity and success to the Naval Construction and Armaments Co., coupled with the name of Mr. Adamson.

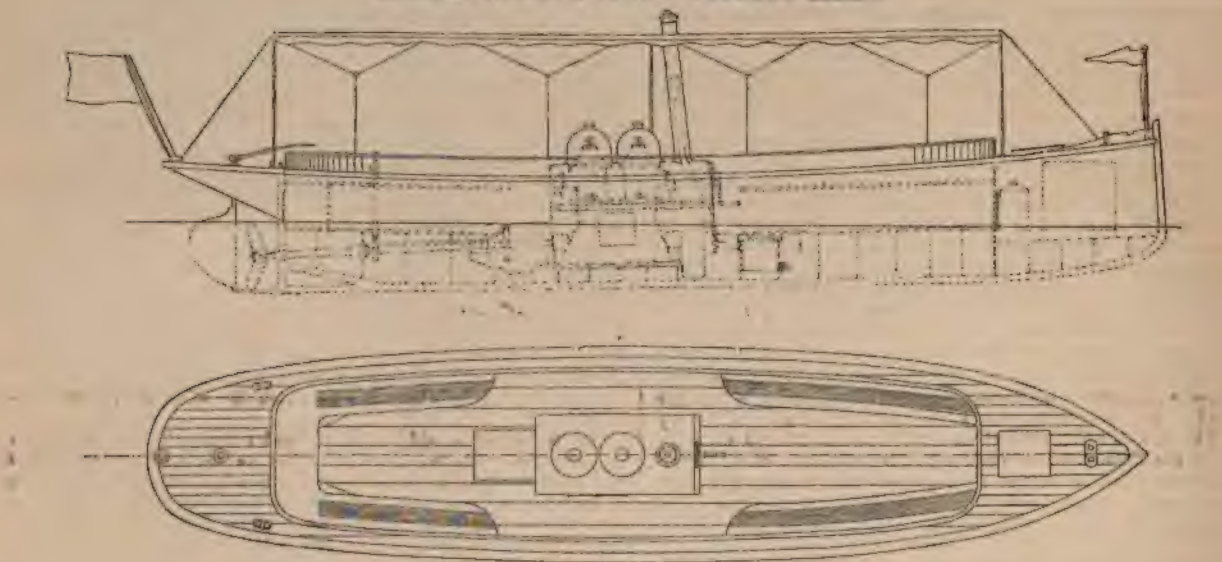
Mr. Adamson briefly responded.

The proceedings then terminated.

Sectional view of a 4 HP. Petroleum Launch with cabin.



Sectional view of a 10 HP. Petroleum Launch.



PETROLEUM LAUNCH.

MUCH has been done during the last few years to develop engines in which the heating agent is used direct in the engine without the heating of any intermediary medium for transmission of the heat between a generator and a motor, and to this class belong the petroleum motors. There is no doubt that there is much to be said for a class of motor in which fuel can be used which can be stowed in a very small capacity, thus affording perfect safety, and at the same time be easy of manipulation in the feeding of it to the engine. We illustrate in the adjoining diagrams sectional views and plans of a 4 and a 10 H.P. launch fitted with petroleum engines, known as the "Capitaine." From these views a very good idea can be obtained as to the amount of space occupied by and the general arrangement of the engines and their accessories.

One of the principal points in which this engine differs from ordinary oil engines is the high speed at which it runs. Ample provision is, however, made to meet difficulties of construction and working, by employing a short stroke, long bearings, and large and efficiently lubricated wearing surfaces generally. We

may mention that some of the special disadvantages of high speed oil engines, experienced up to the present time, have been the difficulty of supplying the charge and causing the explosion to occur quickly and at the right time, the result being incomplete combustion, with a consequent low efficiency, the engine either consuming an undue quantity of oil, or its work being rendered very unsteady and unreliable. We understand that these serious defects have been entirely overcome in this type of engine. The usual speed of the 1 H.P. engine is 350 revolutions per min., and of the 8 H.P. 290 revolutions. Any ordinary mineral oil may be used, the consumption per brake H.P. per hour being about 1 pint in the 1 H.P. engine, ·85 pints in the 2 H.P., and ·7 pint in the larger sizes. Sizes made are 1 and 2 H.P. one cylinder, 4, 6, 8, 10, and 14 H.P. double-cylinder engines. The two-cylinder motors are arranged in such a way that they can be worked with one cylinder only. It may be mentioned that very little smell is emitted while the engine is working, and although running at a high speed, little vibration exists. The flashing-lamp is of a storm-proof type, and both lamp and engine are fed from one tank, which is connected by a pipe to the main tank under the fore deck.

The exhaust may be led by a suitable pipe or funnel, into the atmosphere. The engine is of the vertical type, the cylinder being surmounted by a conical cover or cap, and the piston is of the trunk form, so often used in gas engines. The cylinder has a water jacket supplied with cooling water from the exterior of boat. A small pump at the side of the main frame supplies the gas generator with oil from the tank, through a spraying device. An air inlet non-return valve is arranged on the cap, as also is an exhaust valve. The exhaust valve is devised to open only every second revolution through a very ingenious and simple combination of links, an excentric, and cog wheels. The some excentric operates the petroleum feed-pump.

The cycle of operation of the motive fluid in the motor is as follows:—

When the first down stroke of the piston occurs, the vapourised oil enters the upper part of the cylinder and follows the piston in its descent. Air then enters through a top air valve; but the mixture of the two in an explosive combination is not effected until the up stroke of the piston, when the charge is compressed into the cylinder cap and red hot gas generator, whereupon it is exploded, and the working stroke performed. During the next up stroke, the exhaust valve is opened and the burnt gases escape.

The combustion of the oil vapour is so complete that no disagreeable smell is emitted from the engine. We inspected an engine which was running, the other day, and understand that a large number of these engines are now working satisfactorily in all parts of the world.

We have been informed that the Imperial German Government have given an order for a 14 H.P. engine with the latest improvements, and that the same has been executed to the satisfaction of the Government authorities.

The engines are being put upon the market by Mr. Leop. C. Tolch, engineer, 38, Byrom Street, Liverpool.

LAUNCH OF THE INDIAN GOVERNMENT DESPATCH VESSEL "MINTO."

On Wednesday, March 22nd Messrs. Laird Brothers launched from the Birkenhead Iron Works, a screw despatch vessel, built to the order of the Government of India, and which as she left the ways was named the *Minto*.

The Rev. Canon Linton, Rural Dean of Birkenhead, read the service as appointed for the launching of H.M. ships, after which the christening ceremony was performed by Miss Annie Laird, daughter of Mr. John Laird, Miss Reed being unable to attend. The India Office was represented by Joseph Parker, Esq., Director-General of Stores, and Sir E. J. Reed, K.C.B., M.P., their naval architect and engineer, under whose direction the vessel has been designed and built.

There were also present, Major Aylmer, R.A., Admiral Howard, Chief of the Argentine Naval Commission, and a small party of ladies and gentlemen.

The *Minto* is a handsome vessel built of steel, and is of th awning deck type with clipper stem and elliptic stern, anc rigged with two masts as a fore-and-aft schooner, will present a very smart and yacht-like appearance—teak wood used throughout.

She has a length of 205 ft. 6 in., beam 31 ft. 6 in., depth to awning deck 22 ft. 9 in., and a gross tonnage of about 930 tons.

Her machinery, also constructed by Messrs. Laird, and now ready in the shops, will consist of a set of direct acting inverted engines of the triple-compound type, having cylinders 22 in., 34 in., and 51 in. diameter, with a stroke of 2 ft. 9 in., the pistons, piston rods, crank and thrust shafts of steel, the condenser cylindrical of brass, the propeller of Stone's bronze, four-bladed.

The boilers, cylindrical double-ended, of steel, two in number, about 12 ft. 3 in. diameter and 14 ft. 10 in. long, fitted with corrugated furnaces and iron tubes, and having a total heating surface of about 5,070 square feet—stayed for a working pressure of 160 lbs. per square inch, and proved by water pressure to 255 lbs., as required by the British Admiralty. The intended speed is 15 knots.

Accommodation will be fitted under the awning deck, all specially arranged for the Indian climate. The saloon is aft, extending the full breadth of the ship, suitably decorated and furnished, and also the state cabins, and cabins for captain and military officers. The ship's officers and engineers amidships, and the crew forward. The upper 'tween decks forward and the lower deck forward and aft are available for troops, and there is a large hold forward for stores. Baggage room, magazines, store-rooms, &c. The vessel will be lighted throughout by electricity, for which purpose a very complete installation comprising duplicate dinamos and engines with the other necessary appliances, will be fitted by Messrs. Siemens, Brothers & Co., Limited. To fit the vessel for service in a tropical climate, in addition to very large skylights, sidelights and trunkways ventilation is fitted on the Lee, Anderson compressed air systems extending throughout the living spaces, store-rooms and stoke-holds. The *Minto* will have an armament of four three-pounder quick-firing guns mounted on the awning deck.

SUNDERLAND SHIPOWNERS' SOCIETY.

ANNUAL MEETING.

The annual meeting of the Wear Shipowners' Society was held last month at the Commissioners' Board-room There was a good attendance, and Mr. J. Sanderson, J.P., was voted to the chair.—The secretary (pro tem.). Mr. T. C. Bolam, submitted the annual reports, which showed that only nine bills of importance affecting the shipping industry were introduced into Parliament. The most important was the Loadline and Provisions Bill. Opposition to this measure was made by the representatives of shipowners, and in the result an agreement was come to whereby the clause empowering the Custon House authorities to detain the clearance papers were struck out and a new clause introduced limiting the inspection of provisions to the case of vessels proceeding through the Suez Canal or round the Cape of Good Hope or Cape Horn, and permitting such inspection, wherever practicable, to take place on shore. The other bills were withdrawn at the end of the session. The report next referred to the questions of Welsh coal charters light dues, lay days in American grain charters, pilotage at St,

Petersburg, bulk petroleum in the Suez Canal, wages, negligence clause in American bills of lading, &c., all of which occupied the attention of the society during the past year. The statistics for 1892 showed that there were 79 vessels built on the Wear in 1892, representing 194,076 tons and 16,540 H.P.—The report was adopted on the motion of the Chairman.

On the motion of Mr. Laing, seconded by Mr. Byers, Mr. Jenneson Taylor was unanimously elected president for the ensuing year; and Mr. Charles Booth was appointed hon. secretary.

The question of Lloyd's charges on new ships was brought before the meeting by Mr. J. Y. Short, who said that Lloyd's exorbitant charges had enabled them to accumulate a reserve fund of nearly half a million of money. It was their duty to see that this heavy taxation should not be continued. There was also the question of the representation. The whole of the United Kingdom, with the exception of London and Liverpool, had only sixteen members, while the total was fifty-two. The manner in which Lloyd's ascertained the freeboard was most unsatisfactory. They had no fixed rule; the present method was open to abuse, and unless a change was made Lloyd's Committee would lose the confidence of the builders and owners. He moved that the best thanks be given to Messrs. J. Laing and R. M. Hudson, sen., for their services on Lloyd's Committee.—Mr. T. Stockdale briefly seconded, and the motion was carried.—Mr. Laing, in reply, said that he wished their services had been more effectual. Mr. Hudson and himself had endeavoured as far as possible to get the fees reduced, but they failed to obtain the necessary support to a motion on the subject which he proposed at the last general meeting. Since then something had transpired which led him to hope that the matter would be favourably considered and eventually passed. With regard to freeboard, rules were laid down, but they had not been made public. Certainly it would be an advantage to both shipowners and builders if they knew more accurately what were the principles which guided the committee in assigning the freeboard.—Mr. Hudson also returned thanks. He agreed with Mr. Laing on the excessive fees, and thought it well for them to know that last year the additions to the salaries of those employed by the committee was nearly £5,000. If the press had been admitted to their meetings they would have got a reduction long ago. He moved that the thanks of the meeting be given to the borough members for their readiness to assist in matters affecting the well-being of shipping.—Mr. W. Branfoot seconded, stating that thanks were specially due to Mr. S. Storey for his endeavours to get that very stupid resolution relating to light dues rescinded.—The motion was passed.

After other complimentary resolutions the meeting terminated.

TURNER'S PATENT "CODIFEX" PACKING.

WE have pleasure in bringing to the notice of our readers a new packing, which is being placed upon the market by Messrs. Turner Brothers, of Spotland, Rochdale, under the title of "Codifex." We show this packing in the accompanying illustrations, which clearly define the novel features of the packing, which has been designed for the purpose of obviating the necessity of using expensive metallic packing rings, now so largely adopted by engineers, to form a reliable means of resisting the extreme high pressures of steam used in triple and quadruple expansion engines. The main object of the patentees has been to embody the mechanical advantages of the metal ring packing and of the flexible rope packing made in continuous lengths, after the usual manner, in one combination, in such a way as to leave little or nothing to be desired, either from the one hand or the other. We think that, after careful examination of the details of construction, it will be conceded by the practical engineer that the object aimed at has been successfully [illegible]hed, which fact has been borne out [illegible]acking has withstood the severe tests to which it has been subjected. The packing consists of a rope made from cloth, composed of asbestos and soft metal wire, put together as two triangular sections, to form a square, as shown in Figs. 2 and 3. The packing may, if desired, have the soft metal wire omitted in its construction. The packing is moulded and compressed into shape, so as to present a good, smooth wearing surface, capable of resisting

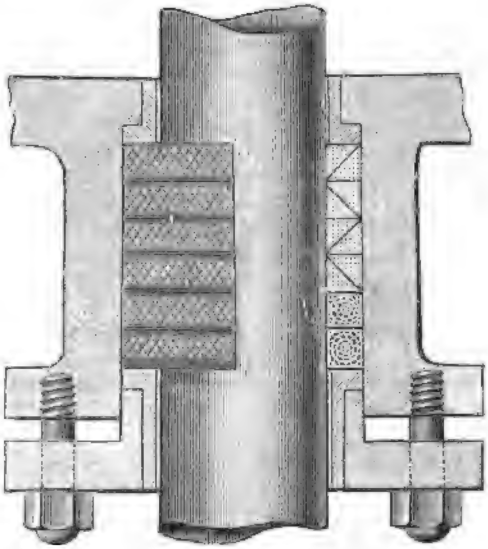


Fig. 1.

great friction, but sufficiently flexible to bend round the piston rod or valve spindle with great ease. We have examined a sample of the packing and are surprised at the remarkable facility with which this can be done. The two triangular sectioned pieces are then surrounded with asbestos cloth, for the purpose of holding them together, for convenience of transit and application. It will thus be seen that a rope formed in this manner is constructed on sound mechanical principles, as embodied in the best types

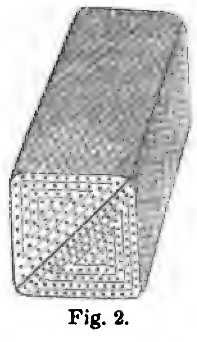


Fig. 2.

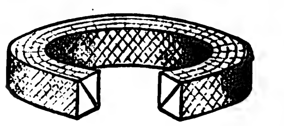


Fig. 3.

of metallic packings, and that when bent into a circle, it partakes exactly of the form of two rings made with inclined edges disposed alternately, so that a stuffing box packed with a succession of turns of this packing, has a series of rings of requisite form to ensure a steam-tight stuffing-box with a minimum amount of friction, as the inclined face of one ring acts on the inclined face of the next ring by the end pressure of the gland producing a sliding motion between them and forcing one ring against the sides of

the stuffing-box and the other against the rod. Whilst this packing is specially designed to meet the requirements of high pressures, it is equally suitable for low pressures and for engines of every type, on account of its simple construction and ease of manipulation, and in order to meet the wishes of engineers with regard to machinery where metallic packing is not needed, it is also made from asbestos cloth without the metal wire. It is suggested that when the rods are worn it may be found that the stuffing-box is not absolutely steam-tight; in such cases a turn or two of soft asbestos packing on the top will suffice to prevent the escape of steam, as shown in Fig. 1.

The advantages claimed for this packing may be summarised as follows:—That by its use stoppages at sea to re-pack are obviated, that it possesses all the simplicity of ordinary rope packing, that it is kept steam-tight with little pressure from the glands, that it is self-adjusting and readily adapts itself to the packing spaces, that the friction is reduced to a minimum, and that no alteration in the stuffing-boxes is required for its use.

We understand that this packing has been highly approved of by eminent engineers, who have prophesied a very successful future for it, in which opinion we heartily concur, as we think that it has the elements necessary for success embodied in it.

MARINE BOILER FURNACES.

At the sixth general meeting of the session of the North-East Coast Institution of Engineers and Shipbuilders, Mr. D. B. Morison concluded his reply to the discussion on his paper on "Marine Boiler Furnaces," which we published in our January number, and the discussions in our February and March numbers. He said:—

In replying to Mr. Milton's explanation of the factor diagram, I again repudiate any intention whatover of attributing intentional unfairness to Lloyd's Registry, and I cordially endorse Mr. Milton's remarks that the reputation of Lloyd's Registry for perfect fairness is world-wide.

In considering the strength of boiler furnaces, it is fortunate we have actual results of experiments as our base, as we thus deal with facts and not opinions. In the first place, Mr. Milton points out the percentage of difference between the best and worst results of the various furnaces, and shows that this variation is as follows:—

1892.	Fox experiments	...	17 per cent.
1888.	Farnley do.	...	20 „
1891.	Holmes do.	...	11 „
1886 & 1887.	Purves do.	...	70 „
1889.	Purves do.	...	20 „
1891.	Morison do.	...	4 „

This is graphically shown on diagram 18, and the noticeable fact is that the test results of the Morison furnace are the most uniform ever obtained, the difference between the best and the worst being only 4 per cent., or about seven times less than the mean variation of the entire series of tests of all the other types of furnaces.

Mr. Milton states that only furnaces of the same thickness can be illustrated by such a figure as the factor diagram, and that if selected tests are taken the basis of selection should be the same in all cases. I entirely agree with this; indeed, these were exactly my views, and as I particularly wished to illustrate everyday practice, I adopted as my standard, or, as Mr. Milton would say, my "basis of selection," the thickness most nearly to that in actual use; consequently the factor diagram is calculated from the means of those test furnaces which are nearest to nine-sixteenths in thickness. These were as follows:—

1890-1.	Fox tests	... ...	·5745
1892.	Do.	... ...	·5745
1886.	Purves' tests	... ...	·557
1887.	Do.	... ...	·612
1889.	Do.	... ...	·5815
1891.	Holmes' tests	... ...	·536
1886.	Farnley tests	... ...	·5535
1891.	Morison tests	... ...	·5485

I much regret the way in which Mr. Milton refers to the *best* tests being taken in one case and the *worst* in others, in order to prepare the factor diagram, as it unfortunately implies dishonesty of motive. Mr. Milton justly remarks that it is undesirable that an undeserved stigma should be allowed to be attached to Lloyd's Registry. To this I would add that it is equally undesirable that any undeserved stigma should be allowed to be attached to my paper, and with your permission I will now remove it, as it entirely arises from a misconception on the part of Mr. Milton.

Referring to the factor diagram, Fig. 19 (page 456, January number), commencing on the left and dealing with the spots marked L only. Spots 1 and 2 (Table 2, page 460, January number), refer to the Board of Trade official tests of the Fox furnace, made at the Leeds forge in 1890-91. The tests were most exhaustive, and were made regardless of expense. Test strips were cut in the presence of the Board of Trade officer and sent direct to Messrs. Kirkcaldy, of London, and after the results were approved by the engineer-in-chief, Mr. Traill, the six plates were made into furnaces, all the operations being conducted under the supervision of a Board of Trade officer, and finally the furnaces were tested by Mr. Samson, chief assistant to the engineer-in-chief. Lloyd's were present at these tests, and took a copy of the various results obtained by Mr. Samson. Table 2 is, therefore, correct in every particular.

The fifth and sixth tests being nearest to the average commercial thickness of nine-sixteenths these were taken, and the mean of the two gives ·5745. The variation of 17 per cent. between the best and the worst of the six tests is explained in my paper, as one of the five-sixteenth plates was rolled thin at one edge, and when made into a furnace, this thin edge became a flat on the furnace end, and as the thickness of this thin plain end was ·331, whilst the mean thickness of the body was ·378, the furnace naturally collapsed at the thin plain end, and this explains much of the 17 per cent. variation which Mr. Milton refers to. The mean tensile of the two tests taken was 28·98 tons, and as the Board of Trade demanded at the tests of the Suspension furnaces that the tensile should be between twenty-six and twenty-eight tons, I took twenty-seven tons as representing the latest official requirements as my basis, and reduced the tensile of the two tests in question with their corresponding collapsing co-efficient to twenty-seven tons in direct proportion in exactly the same manner as Mr. Milton does:

$$29 : 27 : : C : C'$$

My paper describes that the plain tubes are heated before being corrugated, and although they leave the rolls red hot three out of the six were heated again for annealing purposes, and it is a noticeable fact that two out of the three furnaces which were annealed collapsed at the end flat, and the other on the first corrugation, so it would appear that the ends of the three furnaces which were annealed were well heated at that part, and the tensile thereby reduced.

No. 3 spot, Table 5 (page 462, January number), represents the result of the Board of Trade official tests on the Purves' furnace in 1886. These tests were made with the same elaborate care as those previously described, the material being tested by Kirkcaldy, and the experiments conducted by Mr. Samson. Two furnaces only were tested, the mean thickness being ·557, and as that thickness approached very nearly the nine-sixteenth basis it may be inferred that the results represent the strength of the Purves' furnace as manufactured for use in 1886. All the particulars of these two tests are therefore absolutely correct.

No. 4 spot, Table 5, represents the mean of two out of six tests made on the Purves' flue in 1887. The two selected for calculating the diagram were as before, the nearest to the nine-sixteenth basis, viz, the fifth and sixth, which give a mean thickness of ·612. These tests were carried out with the usual degree of excellence by the Board of Trade, and the whole of the results in Table 5 are absolutely correct. Mr. Milton observes that "it is to be noted that these two tests are practically the worst of the six," thus insinuating that they were chosen for that reason. A very little consideration would have shown Mr. Milton that his conclusions were entirely wrong and prevented him from making this unwarranted accusation. His remark

simply draws attention to the fact that by choosing as a basis the furnace having a thickness most nearly approaching that in general use we get with the Purves' design a furnace of the lowest relative strength. I pointed out that physical fact in my paper, and illustrated it very clearly in Fig. 18 (page 456, January number), a reference to which will show that the weakness is no mere accident of experiment, but a direct consequence of the reduction in the proportion in the material in the stiffening ribs to that in the plain part. It cannot be disputed, however, that the results of the two tests I took correspond to those that would be obtained from furnaces manufactured for use at that date, and that alone would justify my position. Mr. Milton says these 1886 and 1887 tests on the Purves' flue were unknown at Lloyd's, but this does not alter the fact that they represent the true state of the manufacture at that date. One test only appears to have been made for Lloyd's in 1886, but in view of the Board of Trade tests made in 1887 its correctness is doubtful, and I did not include it in my paper.

Spot 5, Table 6 (page 462, January number), represents a mean of two of six tests made by the Board of Trade only on the Purves' furnace in 1889, and, as before, I took the mean of the two furnaces, nominally nine-sixteenths thick, for calculating the diagram. It will be observed that the table is very incomplete, and, although I applied to the Board of Trade for particulars, I failed to obtain them. I also wrote to Messrs. John Brown & Co., and they very kindly sent me the tensiles of the test pieces cut from the plates from which the six furnaces were made, at the same time explaining that they could not give me the remaining particulars as they had no record. Some time after I found these tensiles did not agree with the others I obtained, and I wrote Messrs. John Brown & Co. the second time asking them to examine their records again, as I wished the table to be absolutely accurate; to this Mr. Gross kindly replied, confirming the tensiles before given, the mean of which is 28·25 tons. These tensiles are, therefore, correct, but we cannot tell how or where the furnaces collapsed, or whether the furnaces were heated for rounding up and again heated for annealing, or whether heated once only. In either case, however, the tensiles *correspond to those of the original plates*, as in all the other cases. With reference to these tensiles, Mr. Milton says, "The records given by Mr. Morison of the tensile strengths of the steel used in these furnaces is not in accordance with the information we have which led us to take 27·2 tons as the mean strength of the tests." It will be noticed Mr. Milton does not say 27·2 is correct, but that he was "led to take it," yet on this assumption the calculation regulating the manufacture of the furnace seems to have been based. It would be interesting to know whether the 27·2 represents the tensile of the furnace after annealing, but even if that is the case it is still wrong, as the tensiles of all the other tests were taken from the plates after rolling and before they were made into furnaces; indeed, in the Board of Trade experiments no progress is made with the manufacture of the test furnaces until Mr. Traill approves of the tensiles of the test strips. The one test made by Lloyd's in 1890 being incomplete, and the tensile strength being unknown, I thought it better to make no assumption, as the six Board of Trade tests afforded all the data necessary for accuracy.

Spot 6, Table 4 (page 461, January number), represents two out of three tests made by the Board of Trade on Holmes' furnace. This table was revised by Messrs. Holmes & Co., and is correct. The tests taken were the second and third which give a mean thickness of ·536.

Spot 7, Table 3 (page 461, January number), represents two out of five tests made by the Board of Trade on the Farnley furnace, the two taken being the first and second as giving the nearest mean thickness of nine-sixteenths. The table was submitted to the Farnley Iron Co. and returned as correct. The diameters were the subject of special correspondence, and I am assured by the Farnley Co. that they are correct, consequently Mr. Milton would appear to be wrong. No record was kept of the tensiles, but the makers advised me that by taking 28 tons it would be approximately correct, and as Mr. Milton also assumes the same it in no way affects the argument.

Spot 8, Table 7 (page 462, January number), represents two out of six experiments made by the Board of Trade on the Morison furnace in 1892. The appendix contains a detailed report on these tests, the accuracy of which cannot be questioned, as every detail of manufacture was supervised by a special Board of Trade . The test strips cut from the plates gave a mean tensile of 27·2, and it is worthy of special notice that these plates were twice heated after the test strips were cut, once before being corrugated and the second time after corrugation, this final annealing being watched by Mr. Samson, who made a special visit to the Leeds Forge for that purpose, consequently, the tensiles of the furnaces as tested would undoubtedly be lower than 27·2 tons. It will be observed that two out of the six collapsed at the end flat, as against three out of six in the Fox, and the length of the flat is practically 5 in. against 6 in. in Fox. This difference of 1 in. is made much of by Mr. Milton, although I was very careful to deal fully with the question of flats on furnace ends in my paper, giving a diagram of those test furnaces which had failed at the flats. All engineers will agree that long flats on the back top end are undesirable, but if the furnace is made for removal on Ashlin's plan, or that adopted by Messrs. John Brown & Co., there need be practically no flat at that part, the radius of the saddle flange sweeping into the radius of the first corrugation, the design of the Suspension furnace being particularly suited to this arrangement, the long suspension curve being continued into that of the saddle flange, so that no abrupt cavity exists. In furnaces which are not designed for removal it is necessary to leave about 2½ in. of the flat on the top back end, so as to make a joint if the furnace has to be cut out at any time. The next important flat is at the front top, but in no case in the Suspension furnace need this exceed 4½ in. as when it does the makers roll in a Fox corrugation. There remains therefore only the flat at the bottom back end, and even this is only about 6 in. long, and being below the line of fire and behind the bridge it does not accumulate scale and therefore retains its original factor of safety. Mr. Milton's contention is, that if the Morison test furnaces had had the same length of flat as the Fox, viz., 6 in. instead of 5 in., they would have given equal results, and goes on to say that a 6 in. flat is necessary for practical requirements. Let us assume for argument that a 6 in. flat *is* a necessary standard. The question then arises that if the body of a furnace has practically the same resistance to collapse as a plain part at the end 6 in. in length, is there any benefit to be derived from making the body stronger? My opinion is that if the body of a furnace can be made stronger than the 6 in. plain part at the end that it is a stronger furnace as a whole, as the centre of the furnace, or that part above the hottest part of the fire, is certainly the weakest in actual use and should be the strongest under cold water test. If we examine the Fox tests we find three furnaces collapsed on the flats and three on the body, thus it would be reasonable to assume that the body of a Fox furnace is equal in strength to a plain end 6 in. in length. The question now is to determine whether the body of a Morison furnace is stronger than a 6 in. flat. It will be seen on reference to Fig. 23 (page 458, January number), that the mean length of flats of the three Fox tests which collapsed on the flats was six and three-sixteenths, and the mean collapsing co-efficient 80,850, consequently, had the mean length of the flats on the Morison furnace been the same the collapsing co-efficient would naturally also have been about the same, but the mean collapsing co-efficient (calculated on the outside diameter) of the 2nd, 3rd, 4th, and 5th Morison tests, all of which failed on the body, is 89,537, consequently, had the Suspension test furnaces had a length of 6 in. they would all have failed on the flat, and therefore the body of a Suspension furnace is proved by these tests to be stronger than a 6 in. flat on the end, and therefore stronger than the body of a Fox furnace. But Mr. Milton says nothing about the flats in the Farnley or the Purves, although the 1887 experiments of the latter show that a flat of 7½ in. long was stronger in every case than the ribbed body, and still further in the 1890 Purves' experiments, Mr. Milton admits that he knows nothing of the position of the collapse, whether on the flats or in the body, and yet he would seem to depreciate the value of the Suspension tests; but no statements or opinions can alter the fact that they are the most uniform tests ever made, varying only (according to Mr. Milton's own figures) 4 per cent. between the best and the worst, and also that on an equal tensile they gave the highest resistance to collapse on record.

The general accuracy of all the tables having been proved, I will now show by an illustrative example how the Lloyd's spots were calculated. Take Table 2 (page 460, January number) for this purpose, and select the two tests nominally nine-sixteenths thick, viz., the 5th and 6th. The dimensions are—thickness ·574 and ·575, diameter over corrugations 35·593 and 36·937. Apply Lloyd's 1892 rule for corrugated furnaces, which is,

$$\frac{1259\,(t-2)}{D} = \text{working pressure.}$$ Where

t = thickness in sixteenths of an inch.

$$(1)\quad \frac{1259\,[(16 \times \cdot574) - 2]}{35\cdot593} = 254\cdot1$$

$$(2)\quad \frac{1259\,[(16 \times \cdot575) - 2]}{36\cdot937} = 245\cdot4$$

and by dividing the actual collapsing pressures by these working pressures we get the factors of safety thus—

$$(1)\quad \frac{1400}{254\cdot1} = 5\cdot51 \qquad (2)\quad \frac{1410}{254\cdot4} = 5\cdot74$$

which gives a mean factor of safety of 5·63. But this is on a basis of steel having a tensile of 28·98 tons, consequently, the factor when reduced to a basis of 27 tons becomes

$$\frac{5\cdot63 \times 27}{28\cdot98.} = 5\cdot24$$

All the remaining spots are calculated in exactly the same manner, and full particulars will be found in Table 8 (page 463, January number.) I will now apply Mr. Milton's method of calculation to the factor of safety diagram, which represents the factor of safety on the furnaces *when new*. Taking the symbols in the tables we have— $C = \frac{P \times D}{T}$ or $P = \frac{C \times T}{D}$ also

let p = Lloyd's working pressure $= \frac{\text{Lloyd's constant } (t-2)}{D}$

where t = thickness in sixteenths of an inch.

Hence since $\frac{P}{p}$ = factor of safety

$$\text{Factor of safety} = \frac{C \times T}{\text{Lloyd's constant } (t-2)} \text{ or}$$

$$\text{Factor of safety} = \frac{C \times T}{\text{Lloyd's constant } (16\,T-2)}$$

Where T = thickness in inches.

If the factors of safety are now calculated by this formula, we shall get results identical with those given in Fig. 19 (page 456' January number), and as calculated above. For instance, referring again to Table 2 we found that the factors of safety were—

$$(1)\quad \frac{1400}{254\cdot1} = 5\cdot51 \quad\text{and}\quad (2)\quad \frac{1400}{245\cdot4} = 5\cdot74$$

$$\text{also factor of safety} = \frac{C \times T}{\text{Lloyd's constant } (16\,T-2)}$$

substituting the values for C and T we get—

$$(1)\quad \frac{86812 \times \cdot574}{1259 \times [(16 \times \cdot574) - 2]} = \frac{86812 \times \cdot574}{1259 \times (9.184 - 2} = 5.51$$

$$(2)\quad \frac{90576 \times \cdot575}{1259 \times [(16 \times \cdot575) - 2]} = \frac{90576 \times \cdot575}{1259\,(9\cdot2 - 2)} = 5\cdot74$$

which are precisely the same results as above.

Mr. Milton explains that Lloyd's rule contains the expression (t — 2), where *t* is the thickness in sixteenths of an inch, and that this two-sixteenths represents an allowance for corrosion. Now, let us ascertain the factor of safety in the same furnaces when reduced one-eighth by corrosion, this makes the nine-sixteenth furnace into a seven-sixteenths, and reduces the diameter by ¼ in. In furnaces of equal thickness we can take the nearest actual tests to the seven-sixteenths for the purpose, but in a Purves' furnace there will be an undue advantage given to it by the additional material in the rib of a seven-sixteenths new furnace beyond that of a nine-sixteenths when corroded two-sixteenths. As it is necessary to deal with the actual test results, however, we may ignore this advantage thus gained by the Purves, and then calculate the factors of safety as follows— The equation becomes:—

$$\text{Factor of safety} = \frac{C \times T}{\text{Lloyd's constant } (t-0)}$$

$$= \frac{C \times T}{\text{Lloyd's constant } (16\,T-0)} = \frac{\text{Collapsing co-efficient}}{16 \times \text{Lloyd's constant}}$$

which is exactly the equation Mr. Milton uses. In order that there may be no assumptions, I will take the nearest actual tests to seven-sixteeaths, and we will refer again to Table 2. The tests nearest seven-sixteenths in thickness are the 3rd and 4th: viz., ·452 and ·468. The collapsing co-efficients will be:—

$$(1)\quad \frac{35\cdot625 \times 1130}{\cdot452} = 89000 \qquad (2)\quad \frac{36\cdot469 \times 1090}{\cdot468} = 85000$$

and reduced to steel of 27 tons—

$$(1)\quad \frac{89000 \times 27}{29\cdot26} = 82200 \qquad (2)\quad \frac{85000 \times 27}{29\cdot02} = 79000$$

$$\text{Factor of safety} = \frac{C}{16 \text{ Lloyd's constant}} = \frac{C}{16 \times 1259}$$

$$(1)\ \text{Factor} = \frac{82200}{16 \times 1259} = 4\cdot08 \quad (2)\ \text{Factor} = \frac{79000}{16 \times 1259} = 3\cdot92$$

which gives a mean of 4·0. All the other tests have been treated in the same way, and the results are shown in Diagram A.

In addition to Diagram A, I have calculated a second diagram B on the *means* of all the furnace tests except the five-sixteenth Purves; as proposed by Mr. Milton, and I have reduced all these to a basis of steel having a tensile strength of 27·2 tons per square inch, which is Mr. Milton's basis. Taking the Fox tests with Lloyd's 1892 rule as before, we have for new furnaces:—

$$\frac{C \times T}{1259\,(16\,T-2)} = \text{Factor of safety}$$

and calculating the factors of safety by this formula we get the following:—6·65, 5·68, 6·12, 5·75, 5·5, and 5·74, which give a mean of 5·9; and, reducing this to steel of 27·2 tons tensile, we get:—

$$\frac{5\cdot9 \times 27\cdot2}{29\,07} = 5\cdot52$$

For furnaces after corrosion has taken place to the extent of one-eighth the formula becomes:—

$$\frac{C}{1259 \times 16} = \text{Factor of safety}$$

The mean collapsing co-efficient for the six furnaces is 85691, and, substituting this value, we get:—

$$\frac{85691}{1259 \times 16} = 4\cdot25$$

and reduced to steel of 27·2 tons tensile—

$$\frac{4\cdot25 \times 27\cdot2}{29\cdot07} = 3\cdot98$$

All the other spots have been calculated in exactly the same manner.

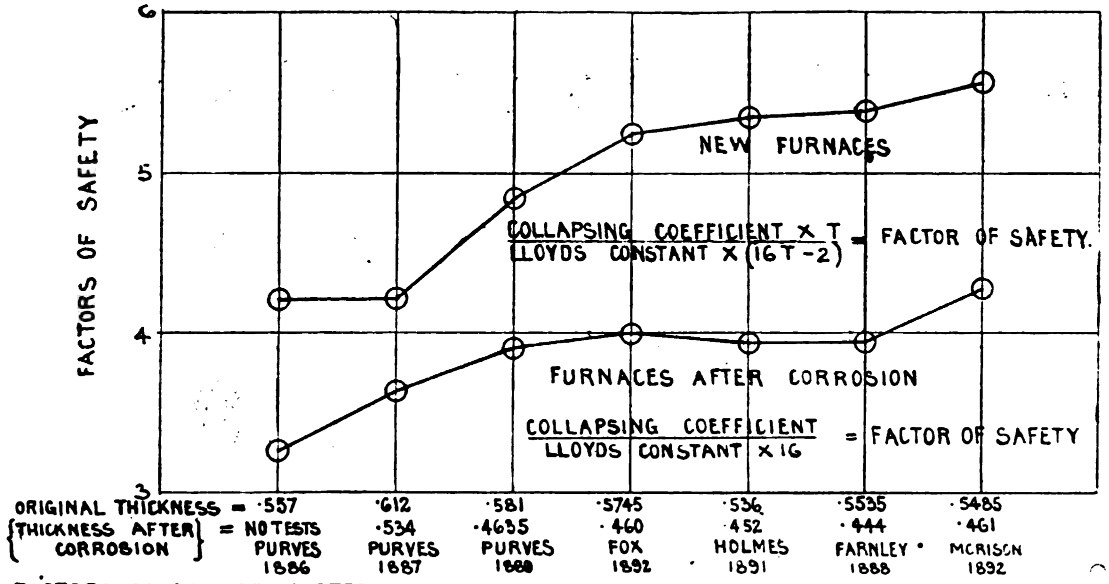
I may add that all my calculations have been made with the slide rule, so that possibly, in some cases, the second and third decimal places in the factors of safety may not be quite accurate. However, this would not materially affect the diagrams.

In comparing the formulæ of the Board of Trade and Lloyd's, it will be seen that the (t—2) in the rule of the latter has the effect of giving a premium to thick furnaces; for example, take a Purves furnace 36 in. inside diameter and seven-sixteenths thick; the working pressure allowed by the Board of Trade for steel from 26 to 30 tons would be 166·3, and by Lloyd's 157·5, or a difference of 8·8 lbs. per square inch in favour of the Board of Trade.

Now take the same furnace five-eighths thick; the Board of Trade working pressure would be 235 and Lloyd's 249, being a difference of 14 lbs. in favour of Lloyd s, or a total difference of 22·8 resulting from the application of Lloyd's formula. But in the Purves design we know that the thicker furnace is relatively the weaker, so the wisdom of the rule applied to this particular design is doubtful. Mr. Milton explains this (t—2) in its general application to all furnaces by saying

DIAGRAM A

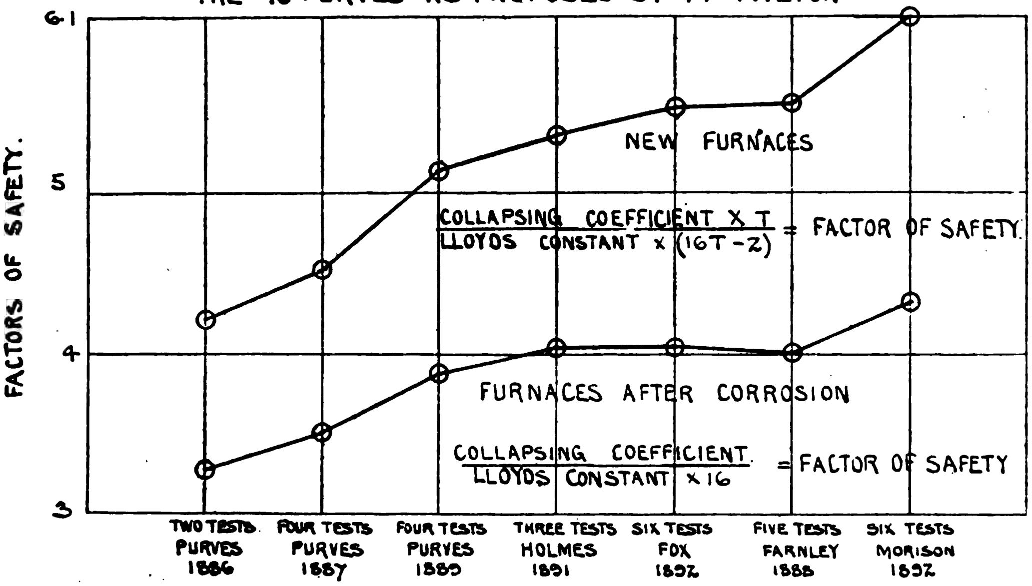
DIAGRAM OF FACTORS OF SAFETY CALCULATED BY LLOYDS FORMULAE.
ON A BASIS OF A 9/16 FURNACE & ALSO WHEN REDUCED 1/8 IN THICKNESS BY CORROSION



FACTORS CALCULATED ON STEEL HAVING A TENSILE STRENGTH OF 27 TONS PER SQUARE INCH.

DIAGRAM B.

DIAGRAM CALCULATED ON THE MEANS OF ALL THE FURNACES EXCEPT
THE 5/16 PURVES AS PROPOSED BY Mr MILTON



FACTORS CALCULATED ON STEEL HAVING A COMMON TENSILE STRENGTH OF 27·2 TONS PER SQ. INCH.

that the strength of a thick furnace is affected less by corrosion than a thin one, but when it is remembered that modern furnaces have a thickness ranging only from about ½ in. to ¾ in., it would seem preferable that the factor of safety should be calculated on the furnaces when new and made sufficiently large to allow for corrosion.

In concluding my reply to Mr. Milton, I wish particularly to state that I do not in any way criticise the amount of the factors of safety, as there is no doubt whatever that the factor of safety on furnaces is less than in any other part of the boiler. In 1888 when the Engineer-in-Chief of the Board of Trade reported on the successful working of 27,000 Fox's furnaces made between 1879 and 1888, and manufactured of low tensile steel, we had had practically 80 lbs. steam pressure and little or no forced draught, now we have pressures of 160 lbs. to 200 lbs. and a good deal of forced draught, consequently the factor of safety should be even greater now than then. Take for example the American Liners, it is quite a common occurrence for some of the furnaces to be set up at the end of a voyage showing the factor of safety has entirely disappeared, consequently, I am certainly of opinion that in forced draught boilers especially, where the temperature is excessive and the liability to scale correspondingly great, the factors of safety allowed both by the Board of Trade and Lloyd's are by no means too large. My contention is not that they are too large in amount, but that they are not equal for all designs of furnaces, and that they should be made equal in justice both to users and manufacturers. Another point is, it would appear to be desirable that the factors of safety should be based on the lowest limit of the range of tensiles; for example, take the ranges to be from 23 to 26 tons and from 26 to 30 tons the factor of safety should undoubtedly be based on the 23 tons in the former case and on the 26 tons in the latter, and not on the means of the range.

Glasgow University Engineering Society.—The closing lecture of the session was delivered in the Engineering Classroom of the University on March 7th, by Mr. C. P. Hogg, C.E. Mr. A. S. Biggart, M.C.Inst.C.E, occupied the chair, supported by Dr. Barr, the Hon. President, and others. The subject of the paper was "Girder Design," and it was fully illustrated throughout by limelight diagrams and photographs. An invitation was sent to the student members of the Institute of Civil Engineers, which was heartily responded to, with the result that a very crowded and successful meeting took place. A lengthy discussion on the paper followed, and the meeting terminated with the usual votes of thanks.—The annual general meeting was held on Thursday evening, 16th inst. Mr. J. H. A. MacIntyre, M.I.M.E., Whit-Sch. (President) presided. Reports by the secretary and treasurer were read and adopted. The following office bearers were elected for ensuing year:—Honorary President, Professor Arch. Barr, D.Sc.; President, J. H. A. MacIntyre, M.I.M.E., Whit.Sch.; Vice-Presidents—Engineering, M. A. E. MacBean; Naval Architecture, P. S. Pilcher: Hon. Secretary, J. Moir Dickson, L.R.Sch.; Treasurer, Patrick Hamilton; Committee: Engineering, J. Gray, G. McKellop, and C. P. Hogg, C.E.; Naval Architecture, A. E. MacIlwaine and J. McGregor. The following gentlemen were elected to honorary membership: — Lord Kelvin, LL.D., D.C.L., F.R.S., J. T. Bottomley, D.Sc., F.R.S., Wm. Jack, LL.D., J. Harvard Biles, M.C.Inst.N.A., W. A. Mackie, N.A., and A. S. Biggart, M.C.Inst.C.E.

Ship Model for the World's Fair.—During the past month there has been on exhibition at the works of Messrs. Welsh & Horn, Hyde Park Street, Glasgow, a very handsome full model of the three-masted steamer *Chateau Yquem*, belonging to the Nouvelle Cie Bordelaise de Navigation, Bordeaux. The vessel is a very fine specimen of her class—386 ft. 6 in. long, 41 ft. broad, by 31 ft. depth moulded; gross tonnage, 4,176. She was built by the Chantiers et Ateliers de La Gironde, and as the model is on the ¼-in. scale it forms a very handsome exhibit. In preparing this model every care has been taken to make it complete in every outward detail, and the result has been a specimen of harmonious and finished workmanship, which it will be very hard to beat. In fact, though Messrs. Welsh & Horn have always been noted for their excellence in this department, they have fairly excelled themselves, and when it is remembered that nothing but the rough wood and metals are bought in, an idea of their thoroughness is obtained. The whole thing stands in a very handsome glass case framed in walnut and satinwood, relieved in gold, and the Clyde-made model of a French built steamer is certain to attract a large amount of attention on the other side. During the month a very large number of gentlemen interested in such matters viewed the model, and congratulations to the makers were universal.

S.S. "Warrnambool."—We have received information of a very interesting incident that has lately taken place in the Australian colonies, particulars of which we give, as they may interest our readers. It appears that Mr. Lund, of the Lund's Line of Steamships, has lately had a new steamer built, which has been named *Warrnambool*, and the local residents of the town of that name have made a presentation to the steamer as an acknowledgment of the compliment paid to the town, by the owner in so naming the new ship. The gift was given by the ladies, and took the form of a handsome flag. The design was that of the house flag of the Lund Line, and the flag was constructed of a white field of corded silk, 12 ft. by 9 ft. with an anchor in blue silk placed diagonally, it being fitted with nickel-plated toggles and a fancy hand pole and rope. The presentation took place on board, and was a most enthusiastic affair, there being a large attendance to a champagne lunch provided by the owner.

Anti-fouling Compositions.—We have received the particulars of an interesting comparative test of two anti-fouling compositions, with a view to arriving at a conclusion as to which of the two was the better article. The particulars are given in the Chilian *Times*. It appears that the South American Steamship Co. had one of their vessels partly painted with a paint that is manufactured in the United States of America, and partly with the paint known as the "International," manufactured by Holzapfel's Composition Co., Limited, Newcastle-on-Tyne. The Steamship Co. had been using a paint for years past that was considered the best in the market, and which necessitated the docking of their vessels about every four months. The vessel experimented upon was the s.s. *Aconcagua*, and after being painted as above described she was not docked again till six months after the paint had been put on, that is two months over the usual time. The result was that that portion painted with the American Co.'s paint was thickly coated with marine growth and some small shells, whereas that part coated with the "International" had only a thin slime upon it. It was agreed by the competent experts who examined the hull, that there was not a shadow of a doubt as to which was the better of the two compositions, as the English one was the cleaner by far and had not blistered at all, and the general opinion appeared to be that its superiority over its American rival would have been still more apparent if the trial had extended over a longer period. This we think should be very encouraging and gratifying to the English manufacturers, especially as the trial has been made by outside steamship owners who could have no reason for favouring either one or the other.

The Institution of Engineers and Shipbuilders of Hong-Kong.—We have received a copy of the report and statement of accounts of the above institution and will briefly give particulars of the same, as it may interest our readers to know how their confreres in the far East conduct the institutions there, which are kindred to our own institutions in this country. The membership roll is now 231, and the committee have lately taken new premises fitted up in modern style with electric light, &c., to meet the requirements of an increased membership roll. This must be considered eminently satisfactory as the institution was only founded in 1891, especially so is this the case, for after paying for the expenditure of installation of new premises, they, this year carry forward a credit balance of over £300. The papers read, judging from their titles, are of interesting subject matter, and we feel sure that our readers join with us in wishing the institutions every success in the future.

D. M. Cumming, Blackhill Dock, Glasgow, launched a steel screw for Union Canal traffic, dimensions, 65 ft. 6 in. by 11 ft. 6 in. by 4 ft. 3 in. moulded, 28th March, 1893.

Messrs. Hawthorn, Leslie & Co., have obtained an order for a 5,000 ton passenger steamer for the Russian Volunteer Fleet. The vessel is to have a speed of 19 knots, and the engines, &c., will be supplied by the builders. During the past few years Messrs. Hawthorn, Leslie & Co. have built several fine steamers for Russia, and their success in securing this order is doubtless due to the high reputation they enjoy in that country as well as elsewhere, as the competition for the order was extremely keen.

NAVAL ENGINEER APPOINTMENTS

The following appointments have been made at the Admiralty from February 22nd, 1893, to March 25th, 1893:—

Allen, Henry J., engineer to the *Royalist*, in lieu of a chief engineer, undated.

Carruthers, David J., assistant engineer to the *Conqueror*, to date February 27th.

Collins, Charles H., engineer to the *Stork*, in lieu of a chief engineer, to date March 6th.

Cook, James A., engineer to the *Spider*, temporarily, to date March 4th.

Deadman, Henry C., assistant engineer to the *Victoria*, undated.

Denbow, William, assistant engineer, has been promoted to the rank of engineer in Her Majesty's fleet.

Edwards, George, engineer to the *Goldfinch*, undated.

Edwards, Robert William, chief engineer, has been advanced to the rank of staff engineer.

Eyre, Charles Vickers, assistant engineer, has been promoted to the rank of engineer in Her Majesty's fleet.

Foreman, Felix, fleet engineer to the *Victoria*, undated.

Gilbert, William, fleet engineer to the *Vivid*, additional, to date March 1st.

Goldsmith, Henry C., fleet engineer to the *Bacchante*, to date February 27th.

Harding, Frederick G., engineer to the *Victoria*, undated.

Hatelie, David, engineer to the *Pembroke*, additional, for the *Icarus*, to date March 2nd.

Hatherley, William E., assistant engineer to the *Victoria*, undated.

Hudson, George W., engineer to the *Surprise*, in lieu of a chief engineer, to date February 27th.

Lee, Richard S., fleet engineer to the *Victoria and Albert*, to date February 21st.

M'Carthy, John, staff engineer to the *Achilles*, to date March 2nd.

Moysey, Alfred H., assistant engineer to the *Iron Duke*, to date March 6th.

Murray, George W., engineer to the *Superb*, to date March 2nd.

Oram, Henry John, chief engineer, has been advanced to the rank of staff engineer in Her Majesty's fleet.

Osbourne, Charles E. H., assistant engineer to the *Neptune*, to date March 2nd.

Pamphlett, W. F., chief engineer to the *Bonaventure*, to date March 6th.

Parker, W. N., engineer to the *Gleaner*, to date March 6th.

Parrott, Jasper W. A., engineer to the *Acorn*, to date March 18th.

Pascoe, George, engineer to the *Egeria*, to date March 2nd.

Pearse, William W., engineer to the *Nelson*, to date March 18th.

Philips, Richard, engineer to the *Curacoa*, in lieu of a chief engineer, to date March 6th.

Pitt, John, staff engineer, has been advanced to the rank of fleet engineer.

Rawlingson, Walter W. H., engineer to the *Victoria*, undated.

Reynolds, Thomas R., engineer to the *Penguin*, additional, and for appointment when re-commissioned, to date March 2nd.

Roffey, James R., engineer to the *Achilles*, undated.

Seaton, William R., assistant to the *Victoria*, undated.

Serle, Richard T., staff engineer to the *Gorgon*, to date March 1st.

Sheen, Charles C., assistant engineer to the *Orlando*, to date March 6th.

Spence, Robert (probationary), assistant engineer to the *Tamar*, to date March 18th.

Tregenna, Henry Ernest, assistant engineer, has been advanced to the rank of engineer in Her Majesty's fleet.

Walker, Henry J., chief engineer to the *Thunderer*, to date February 27th.

Wallis, Henry, engineer to the *Pembroke*, in lieu of a chief engineer, to date March 6th.

The Admiralty purpose to appoint a chief engineer as resident overseer at Woolwich for the inspection of mountings for naval ordnance.

Irene.—On March 3rd there was launched from the Reiherstieg Shipbuilding Yard, Germany, the steamer *Irene*, built for the Deutsche Dampfschiffs Rhederei, Hamburg. The vessel, which is 350 ft. long, has a carrying capacity of 4,500 tons.

HOAR & BROWN'S HARDWOOD MARKET REPORT, 24th MARCH, 1893.

TEAK—	LOGS. *Loads.*	PLANKS. *Loads.*	BLOCKS. *Loads.*	TOTAL. *Loads.*
Stock, 1st March, 1893	7,629	2,829	7	10,465
Landings	2,610	416	60	3,086
	10,239	3,245	67	13,551
Deliveries	551	154	60	765
Stock, 22nd March, 1893	9,688	3,091	7	12,786

The Admiralty requirements have been decided greatly in favour of selection from landed stock, and when this clearance of so considerable a quantity of first-class logs has taken place, the teak field of the West India Docks will bear a very different aspect to what it has at the present time. Should the steamer shipments be restricted, and any demand show itself, there will be found some difficulty in obtaining large quantities of prime squares.

There is little immediate prospect of a rise in prices, and the demand continues slack, while the stock appears large.

Planks have not arrived quite so freely of late, and it is understood that the low values obtained on this side have compelled some of the shippers to close their mills. Quotations remain very low indeed, and it would be advisable for consumers to pick up parcels while the chance is offered.

MAHOGANY.—Market values remain high for medium to large sizes of good quality and condition, also for anything with indication of figure. Small wood has experienced a further fall, and little notice is taken of minimum classes.

Stocks of good quality and sizes are not at all excessive, and with an ordinary demand the market would soon be cleared, leaving the hand-to-mouth purchasers difficult to accommodate with their dainty requirements. Cuba and Spanish experience the same feeling, figury logs fetching unusual prices.

CEDAR is in good demand, the market being entirely bare of any stock fit for panel or boat-building purposes, and sound, straight wood, of reasonable sizes would readily sell at much advanced figures. The only stock of logs comprising timber of any size consists of Paraguay, and even this is but small in quantity.

WHITEWOOD LOGS are very difficult of sale, while planks and boards are in great request. The imports of the latter have fallen off lately, and any shipments of fair quality are readily disposed of at enhanced values.

SEQUOIA.—Small sales are constantly being made at exceedingly low prices, and further arrivals are reported. No more without reserve sales are expected to take place at present.

KAWRIE PINE.—Several enquiries are about, and stocks here being small, shippers ought to do fairly well; but it is hoped they will be cautious not to ship in large quantities, otherwise prices will again revert to the low point reached last year, the demand being limited.

SATIN WALNUT.—The only trade lately done in this wood has been caused by the low prices realised at the without reserve public sale, the logs having readily changed hands, but for any wood at legitimate prices, the demand is almost *nil*.

AMERICAN WALNUT.—Several large parcels of logs have changed hands, but at lower figures, owing to the continued arrivals. The demand for really first quality wood is still large, and at remunerative rates. Planks and boards for the better qualities have been in good request at fair prices, but for the lower grades and culls, enquiries are very few and far between. The imports of the latter descriptions have been far in excess of the demand, and unless they are greatly reduced, shippers will ultimately realize serious losses.

GREENHEART.—The Admiralty have given their order to the London market, but their requirements are small, and not likely to affect prices.

Buenos Ayres.—On March 3rd there was launched from the yard of Messrs. Blohm & Voss, Hamburg, the steel screw steamer *Buenos Ayres*, built for the Hamburg and South American Steam Navigation Co. The vessel, which is 327 ft. long has a deadweight carrying capacity of 4,500 tons

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(From our own Correspondent.)

It is with pleasure that we report a slight improvement in shipbuilding, engineering and allied trades during the past month. The improvement, though very slight, is still apparent, and one or two new orders should be placed in April or we will be much disappointed. In the manufacrured iron trade a distinct move took place, and several of the iron and steel works in this district, which were on short time, have had the heart to return to the full week's working time. Foundry and moulding departments, are, however, still almost at a standstill and will be for some time, though they also will feel the slight improvement in the course of a month or so.

Amongst new orders posted, that for the ferryboat for Woolwich placed with Messrs. Simons & Co., Renfrew, was perhaps the most interesting, on account of the discussion which took place in the London County Council on the head of wages to be paid, and it is very gratifying to note the excellent way that Messrs. Simons & Co. came out of it. There is evidently a large labour representation in the Council, but they could certainly never expect to rule the wages market in Scotland, and it is a necessary point in business that the wages question shall be settled between masters and men without the interference of a third party in the shape of the buyers. In the beginning of the month Messrs. J. & G. Thomson, Clydebank, received an order to construct a fine paddle saloon steamer for the Belfast, Holywood, and Bangor service. The steamer is to be somewhat similar to the *Glen Sannox*, and the other two paddle steamers at present building by this firm for the Glasgow and South Western Railway Co. Messrs. Hawthorns & Co., Leith, have received an order from Mr. T. Devlin, Newhaven, to build a large steam trawler for the North Sea fishing, and this will be received with pleasure as the shipbuilding yards at Leith are in a very dull state indeed. It is to be hoped that several new orders will be placed Leith way.

On the 17th instant the s.s. *Campania*, which has for some time past been lying at Plantation Quay, Glasgow, left the river and proceeded down to the Tail of the Bank for her preliminary trials, which commenced on the 21st. She will afterwards proceed on a trip round Ireland, returning to Liverpool, where she will go into dry dock. She will then return to Greenock where her final trials will take place. She is expected to commence on her regular route about the end of April. Before leaving the Clyde, by the invitation of the Cunard Co., a large number of ladies and gentlemen visited the vessel and were shown through her. The upholstery work is not yet completed, but things are sufficiently far forward to give an excellent idea of the magnificence of the floating palace. On the 19th inst. H.M.S. *Ramilies* left Messrs. Thomson's dock at Clydebank, and proceeded to the Tail of the Bank, where she has taken up a position near the *Campania*.

On March 2nd the new telegraph steamer *Norseman*, built and engined by Messrs. Ramage & Ferguson, Limited, Leith, for the Western and Brazilian Telegraph Co., Limited, London, left the Firth of Forth to take up her station on the East coast of South America, *via* London, where a large consignment of cable is to be taken on board. The cable-laying machinery, supplied by Messrs. King, Brown & Co., Edinburgh, is on the fore deck, and abaft are the cable tanks, capable of holding many hundred miles of telegraph cable. The *Norseman* takes the place on the coast of the company's other vessel of the same name, and is commanded by Captain Lacy.

There is still a considerable quantity of tonnage on hand, but as it is placed in the water several firms are unable to fill the vacant berths, and in these yards poles are about all that can be seen. Messrs. Napiers' yard is an example of this, only one vessel being seen, and that is nearly plated. H.M.S. *Gibraltar*, which has been lying alongside this yard for some time, will soon be completed and away. In the London and Glasgow Shipbuilding and Engineering Co.'s yard a great absence of work is noted, only one boat, which will be launched next monh, being on the blocks. At Messrs. Inglis' yard at Pointhouse there is one new vessel fitting out, whilst there are two large petroleum vessels well on with the plating. In the Fairfield Co.'s Dock the s.s. *Lucania* is fitting out, whilst the s.s. *Hound* for Messrs. Burns' cross-channel line, is almost completed, and will be ready for her trial early next month. At Messrs. A. Stephen & Son's yard, Linthouse, a very large cargo steamer was launched, whilst another large vessel for London owners for the Persian Gulf line is almost ready for her native element. This firm have two other vessels on hand, and altogether their yard is one of the busiest on the Clyde. At the Whiteinch side there are two large steamers plated, and two small steamers ready for launching. At Yoker and Renfrew a fair quantity of specialities are on the stocks, whilst at Clydebank Messrs. Thomson have the second Royal Mail steamer and three fast paddle steamers to go on with. At Paisley there are one or two vessels building, the most notable being the 1,250 ton *Hopper* barge in Messrs. Fleming & Ferguson's yard.

A moderate amount of repair work has been done in the engine shops, but owners are at present very slow to countenance any expenditure until freights are more remunerative. The Electric Anti-Corrosion Co., during the month, gave a demonstration of a new process for the cleansing and preservation of boilers, on board the steamer *Tenasserim*, lying in the Queen's Dock. The method explained consisted of periodically sending currents of electricity through the shell of the boilers by means of fixed electrodes, which process disintegrates the scale formed on the shell and tubes. The local agents for the company are Messrs. R. D. Smillie & Co., 113, West Regent Street, Glasgow.

The new 130-ton crane recently erected at Finnieston Quay will be tested by the time this is issued, when we have no doubt everything will be found satisfactory.

Messrs. George Turnbull & Co., Leith, have arranged to start on the 25th inst. a new monthly service between Leith and Australia.

TRADE NOTES FROM THE TYNE, WEAR, TEES, HARTLEPOOLS, &c.

(From our own Correspondent.)

THE TYNE.

Shipbuilding.—The first quarter of the year has been marked by almost unprecedented depression in shipbuilding, and though some firms have been able to maintain an appearance of considerable activity in their yards, by far the greater number have been compelled to restrict productive operations. Though few orders have been placed during March, enquiries have not been wholly absent, and notwithstanding the fact that a large amount of tonnage is unemployed, it is quite evident that some shipowners are willing to acquire new boats, provided their conditions as regards price are agreed to. These conditions, however, are usually very exacting, so much so, indeed that the shipbuilder can only meet them by facing the prospect of certain loss on the transaction. More than one order has passed from the Tyne lately, owing to the very natural disinclination of shipbuilders to accept them at prices which would not cover the cost of labour and material, to say nothing of their inadequacy to provide a surplus towards the payment of standing charges. The only change in existing conditions which could enable shipbuilders to take contracts at the very low prices which are now obtainable is a general and substantial reduction of wages rates, and it may be stated with certainty that measures to effect this change will very shortly be undertaken. There is, indeed, now a dispute in progress at one establishment owing to the determination of the management to reduce the wages of the labourers, which action the latter have resisted. It has been reported during the month that Messrs. The Palmer's Shipbuilding and Iron Co., Limited, had secured several orders for vessels which it was understood would be laid down in their Jarrow yard. The report wants confirmation, however, and in this connection it may be stated that as yet no signs of preparing for the laying down of vessels are observable at the establishment mentioned. At the Howden yard, belonging to the firm, business is still pretty active, and a number of the hands who were left idle from the Jarrow yard have found employment there. The Tyne Shipbuilding Co. have now no vessels on the stocks, and the yard has an unusually bare appearance. Preparations for laying down a vessel in one of the berths are now in progress however, and it may be in-

ferred that the establishment will soon resume the aspect of briskness which ordinarily distinguishes it. The Edwards' Shipbuilding Co. have a large vessel in course of framing, and the construction of the pontoon mentioned in last month's Notes is about to be commenced. This pontoon, it may be stated, is to be 300 ft. long, and of proportionate dimensions in other respects. The extensions which are being made at Messrs. John Readhead & Son's yard, are of more importance than was indicated in a former notice. The whole of the building berths (five in number) are to be made 41 ft. longer than at present, an alteration which will admit of the laying down of vessels of the very largest class. The necessity of altering these berths in the manner stated, furnishes a remarkable illustration of the rapidity with which new ideas are being adopted in shipbuilding, for Messrs. Readhead's yard is comparatively modern, and when the building berths were formed, the space allotted to them would no doubt have been considered fully adequate to the requirements of the time. It is but right to add that, though the yard at present occupied by the firm is modern, that description does not apply to the firm itself, which is one of the oldest on the river. The firm lately launched a vessel for a firm at St. Ives, which is the twenty-sixth turned out for the same owners. It is needless to say, that this circumstance is creditable to the firm, as illustrating their ability to retain the confidence of customers, over such a number of years. Messrs. W. Dobson & Co. are understood to have disposed of a vessel, recently completed, to a German owner, and the firm have two other vessels in early stages of construction on the stocks. Messrs. Wood & Skinner have but one vessel on the stocks, and as this is nearly completed, and there are no signs of other work being in preparation it is to be feared that the comparative briskness which during the winter has distinguished this yard is for the present at all events to be brought to a close. The yards of Messrs. Armstrong, Mitchell & Co., Messrs. Wigham, Richardson & Co., and Messrs. C. S. Swan & Hunter, continue to show satisfactory briskness; but no less than four establishments on the river remain untenanted so far as regards vessels in progress. Messrs. Anderson & Laverick, of the Mushroom yard, have a large tug-boat on the stocks, ordered by London owners. The vessel is to be supplied with triple-expansion engines by Messrs. Stewart & Co., Blackwall, and is expected to be an exceptionally powerful craft. The firm who have within a recent period greatly added to the productive facilities of the yard, have an order for another vessel of lairger dimensions than the one referred to, and more nquiries are coming to hand. The days of wood shipbuilding are not yet quite over, for a wood fishing vessel about 100 ft. long is now being constructed at St. Anthony's. It is expected that this small but interesting craft will be put into the water in the course of a few weeks. The Blyth Shipbuilding Co. are still having a fair amount of new work in progress, and in the repairing line they are also pretty well occupied, both their large graving docks being in almost constant use.

Engineering.—The employers in the engineering trades have at last taken a step which has been contemplated for some time, and which is rendered absolutely necessary by the extreme dulness of business. This is, the issuing of a notice intimating that a wages reduction of 5 per cent. in some cases and 10 per cent. in others will be required at the beginning of May. Neither the men concerned nor the general public have been unprepared for this, as it was well known that contracts were not to be got, except at greatly reduced quotations, and to meet this state of matters it was found that a wages' reduction was inevitable. The only point upon which any difference of opinion is likely to arise is the amount of the reduction, as the operatives will doubtless try to effect a compromise by offering to agree to a smaller reduction than that asked for. Whatever difference may arise on this head is, however, likely to be speedily adjusted, and no fears are entertained that in connection with this question any breach of the friendly relations now existing will occur. It may be added that the notice for reduction applies to the operatives in the boiler shops, as well as to those in the engineering establishments, and that some 15,000 men on the Tyne and Wear will be affected. In marine engine shops there is little change since last month; but it may be stated that in addition to the St. Peter's, the Neptune, and the Wallsend Slipway engine works, Messrs. Readhead's establishment at Tyne Dock is keeping satisfactorily busy. A large oil-boat, named the *James Brand*, is now receiving her machinery at the Slipway works, and the ss. *Trefusis* is being engined at Messrs. Readhead's. At most of the larger engineering establishments in the vicinity of Newcastle short time is being resorted to. Messrs. Emerson, Walker & Thompson Bros., Limited, constitute an exception, as they are able to keep their machinery going full, and are further adding to their productive capacity by putting down new plant, including several steam-hammers. Messrs. Donkin & Co. (late Donkin & Nichol), of the St. Andrew's Engine Works, are also keeping well employed, having orders in hand for over 20 steering-gears, a large proportion of which are from foreign owners, while some are from owners of vessels that are being built on the Clyde. The firm have also a number of orders for engine-room, telegraphs, forced-draught and ventilating fans, ash hoists, &c. The firm receive frequent enquiries in respect of their various specialities from abroad, and have just completed an order from Genoa. Mr. W. F. Snowden, of 32, Side, Newcastle, has within the past month secured several orders for Morison's Evaporator, for which speciality he is the local agent, and among them may be mentioned one for a steamer belonging to Danish owners. Messrs. Geo. Angus & Co. continue to have a fair demand for their packings and other engineering specialities, and their works are kept in steady operation. Forges, foundries, and ironworks are slack, with little prospect of early improvement.

Electric Lighting.—Messrs. Rowland Barnett & Co., of the Walker Gate Electrical Works, have removed their Newcastle office from 13, Grey Street, to more commodious and suitable premises in Dean Street. Messrs. E. Scott & Mountain, Limited, are very busy in their electrical department, among other orders recently received being one for a ship installation at Sunderland and one for the lighting of a public institution at Edinburgh. Messrs. Clark, Chapman & Co. continue to be busy in ship lighting, and Messrs. J. H. Holmes & Co. have a good many contracts for the same class of work. Most of the other electric lighting firms are well employed.

THE WEAR.

Shipbuilding.—Since last month a very marked improvement has taken place at the yard of Messrs. J. L. Thompson & Sons, and the number of men employed has been largely increased. There are five vessels on the stocks, most of which are in early stages, and the outlook for the next few months is satisfactory. In addition to the new work, the firm have an extensive repair contract to carry out on the s.s. *Forest Holme*, which, on her last voyage, suffered great damage from a tidal wave of immense volume, which struck the vessel while going at slow speed. Had it not been for the soundness of the vessel's construction, she must inevitably have gone down; as it was, her maindeck forward was completely stove in, which injury involved also the destruction of bulwarks, charthouse and other structural parts, that had been momentarily submerged. The vessel is now lying at the Manor's Quay Repairing Works, but will shortly be placed in one of the Wear Commissioner's graving docks to be thoroughly overhauled. Messrs. Blumer & Co. have two vessels on the stocks, and at the Sunderland Shipbuilding Co.'s yard there are three vessels in progress. The establishment of Messrs. Bartram & Haswell is again assuming an appearance of tolerable briskness, and at Messrs. Austin & Son's yard the work in hand is scarcely less than in busy periods of trade. Besides two new vessels that are in progress, the s.s. *Cookham* is undergoing an extensive overhaul in the graving dock, the greater part of the bottom having to be renewed. The firm have recently put down a quantity of new plant, the most important item of which is a 16 h.p. "Fielding" gas engine, which has been some time at work and is giving great satisfaction. Among the latest additions to the plant is a powerful punching and shearing machine of the newest type, which has been supplied by a well-known firm at Glasgow. Messrs. R. Thompson & Sons are repairing the locally owned steamer *Auricula* in the Bridge Dock, and they have a vessel in an advanced stage of construction at the Southwick yard. It is to be feared, however, that a period of slackness will be experienced at the last named establishment, as there are no indications of any further work being in preparation. At Mr. Laing's yard the briskness noted last month is continued, the construction of oil carrying vessels contributing largely to the maintenance of activity. Messrs. Pickersgill have only one small vessel on the stocks, and but a limited number of men employed, while Messrs. Priestman & Co. have two vessels building, both being of pretty large dimensions. The larger one, which is 300 ft. long, was put down on the speculative principle some months ago, with the view of keeping the superintending staff together, and as many of the

hands as possible in employment. At Messrs. Doxford's yard, where almost complete idleness has existed for some time, preparations are being made for laying down a vessel of special type, and considerable quantities of material are being received. During the interval of slackness a commodious fitting shop has been erected in contiguity to the shear-legs on the wharf, by which addition to the premises the work of fitting out new vessels will be greatly facilitated. The yard of Messrs. Short Bros. continues fairly busy, but at Messrs. Osborne & Graham's establishment there is little doing. It is understood that a newly organised firm have acquired a site at South Hylton, which was formerly occupied for shipbuilding purposes, with the intention of commencing business as builders of fishing vessels and other small craft. The starting of such a venture at a time like the present, denotes the possession by the promoters of an enterprising spirit which deserves success, and it is to be hoped they will attain it. It is believed that the demand for small vessels of the class indicated is just now fairly good.

Some returns have been published which show that during the first quarter of the present year, eight vessels, representing an aggregate tonnage of 18,225 tons, have been launched on the Wear, as against 17 vessels, of 37,164 tons, launched in the first quarter of 1892. The number of vessels now in course of construction is given as 28, having a total tonnage of 72,812 tons, as against 50 vessels of 128,688 tons in course of building at the corresponding period of last year. These figures indicate the depth of the depression in Sunderland, which, by the way, is better off in the matter of work in progress than many other centres.

Engineering.—Meetings of the engineering operatives have been held within the past few days in reference to the proposed reduction of wages, and a decision has been arrived at by representatives of the sectional trades to leave the matter in the hands of the joint wages committee of the Tyne and Wear, which is to meet in Newcastle shortly. It is not yet known whether the members of the Amalgamated Society of Engineers will in any action arising out of the matter, make common cause with the sectional trades, or otherwise. Up to the time of writing the boilershop operatives have not held any meetings in reference to this matter. The marine engine works continue very slack, but at one or two establishments, it is expected that some improvement will be experienced in the course of a few weeks. It is probable that this expectation is founded on the prospect of a general reduction of wages enabling the employers to compete for work with better chances of success. Messrs. John Lynn & Co. are taking advantage of the present dulness to prepare for the exigencies of a brisker demand for their specialities in the future. With this end in view they have commenced the erection of a substantial building, which when completed, will be fully as large as their existing premises, thus doubling their productive capacity. They have purchased a quantity of new machinery for the equipment of the building, and have decided to use gas in preference to steam, as the motive power. A 16 H.-P. gas engine has been ordered, and it is expected that the whole will be in readiness for work within a month from now. Messrs. Lynn's specialities are steering gear and steam winches, and for both of these classes of deck accessories they have now a good many orders in hand. Business at the Monkwearmouth Ironworks is just now very dull, and the operatives for some time past have been working only half-time. Foundries are also slack, but at the Monkwearmouth Foundry considerable extensions are in progress. At the chain and anchor manufactories there is not much doing. The rope works of Messrs. Dawson & Usher, Hendon Road, are kept well employed, principally on ships' rigging.

The Hartlepools.—The shipbuilding yards at this centre are on the whole fairly busy, though the amount of work in hand is very far short of the quantity on the stocks a year ago. There are repair contracts in progress, which help to keep a good many men in partial employment. At the Central Marine Engine Works business is still satisfactory, and however scarce orders may be elsewhere, there does not seem to be much likelihood of this establishment being touched by depression to any very marked extent. A "conversion" contract, which has excited a good deal of interest, has been carried out at these works lately. This was the altering of the compound engines of an old steamer named the *Mark Lane*, to what may be called the high pressure, two-cylinder compound type, by fitting in new liners and substituting two new boilers for the old, worn out ones. The ship took her trial trip in Hartlepool Bay on the 14th inst., and it was found that the engines could be handled most satisfactorily. When fully let out they ran freely at 70 revolutions per minute, with the vessel drawing 14 ft. 6 in. aft, and the speed 12¼ knots. This excellent result was doubtless largely attributable to the vessel's propeller, which is one of the special type manufactured at the Central Works. The boilers kept up the steam pressure with ease, and the trial, on the whole, seemed to give promise of complete success in actual work. This is an economical method of adapting old engines to modern requirements, and is likely to answer well in cases where the vessel is not considered sufficiently valuable to be fitted with complete new triple engines, as well as new boilers. At the Hartlepool Docks trade continues dull, and is likely to remain so till the opening of the timber import season, some months hence.

The Tees.—Messrs. Ropner & Son launched, on the 21st inst., a vessel 305 ft. long by 40 ft. 6 in. beam, and having a carrying capacity of 4,450 tons. The vessel, which is named the *Hannah M. Bell*, has been ordered by a new steamship company, bearing the same name. The following steamers, engined by Messrs. Blair & Co., have had their trial trips during February:—On February 18th the s.s. *Resolve*, built by Messrs. R. Stephenson & Co., Hebburn-on-Tyne, for Messrs. McIntyre Bros., of Newcastle, having engines with cylinders 23½ in., 39 in., and 64 in. by 42 in. stroke, 170 lbs. pressure of steam. On February 25th the s.s. *Frey*, built by Messrs. Ropner & Son, Stockton-on-Tees, for Jacob Olsen, Esq., of Bergen, having engines with cylinders 23 in., 37½ in., and 61½ in. by 39 stroke, steam pressure 160 lbs. On February 27th the s.s. *Byzanz*, built by Messrs. Wm. Dobson & Co., Walker-on-Tyne, and sold to Messrs. A. C. de Frictees & Co., of Hamburg, having engines with cylinders 19 in., 31½ in., and 51½ in. by 36 in. stroke. This vessel was originally named the s.s. *Godrevy*. On February 24th the *Calio San Sabastian*, built by Messrs. J. L. Thompson & Sons, of Sunderland, for Messrs. Ybarra & Co., of Seville, Spain, having engines with cylinders 18 in., 29½ in., and 48½ in. by 33 in. stroke. On February 28th the s.s. *Burton*, built by Messrs. The Edwards' Shipbuilding Co., of Howden-on-Tyne, and sold to Messrs. Samman & Co., of Hull, having engines with cylinders 20½ in., 33½ in., and 55 in. by 36 in. stroke. The firm have just completed the conversion of the old compound engines of the s.s. *Germania*, owned by Messrs. The International Line Steamship Co., of Whitby, into engines of the triple-expansion type (with new boiler of 160 lbs. steam pressure), having cylinders 21½ in., 35½ in., and 58½ in. by 39 in. stroke. The results of the foregoing trials were in every case completely satisfactory. At Middlesbro' great dulness exists in both shipbuilding and engineering works.

Consett.—The Consett Iron Co. have recently commenced operations in their new steel angle mills, and are now turning out large quantities of material weekly. The steel plate mills are kept fully going, the average weekly output reaching nearly 3,000 tons.

NORTH-WEST OF ENGLAND.

(From our own Correspondent.)

Barrow-in-Furness.—The shipbuilding industry at Barrow is now beginning to feel the full brunt of the depression in trade, which has for some time been experienced in other centres of trade. As the orders in hand are gradually being disposed of, men are being turned away, but this is only a temporary expedient, as new orders recently received will find a renewal of work as soon as they can be pushed sufficiently forward. In the meantime, however, some of the platers, rivetters, &c., are idle. It is expected new orders will soon be booked, as many enquiries have lately been made, and local builders are said to stand well for some of the tonnage which is on offer. With so much shipping lying idle it is not expected, however, there will be many new orders placed during the spring of this year, but there are some cases in which new ships are necessary, and there are other cases in which owners looking well forward to the future, are taking advantage of cheap prices to get ships built to be ready for better times when a revival takes place. There is also a growing inclination on the part of shipping owners to break up some of their old steamers, and dispose of the metal as well as they possibly can, and use the money thus obtained as a basis for building new ships. The old type of vessel, with compound engines, is of no use to the trade of to-day, unless the hull is sound enough to justify the cost of tripling the engines. It is therefore seen to be the truest economy to realise old and obsolete ships for what

they are worth, as they will probably never be employed again, and will eat their heads off in interest and dock dues and charges. The work in hand at Barrow has made considerable progress during the month. A remarkable dredger, described in another column, was launched from the yard of the Naval Construction and Armaments Co. for the Mersey Dock and Harbour Board. She will be almost filled with machinery, powerful pumps, &c., and will, if she succeeds—as there is little doubt she will—almost revolutionise dredging operations, especially at entrances to harbours, where great bodies of sand act as barriers to navigation. The British and African steamer, *Jamaican*, has been completed and delivered to her owners after a very satisfactory trial as to speed and general capabilities at sea. The N.C. & A. Co. have also been engaged in most satisfactory trials with H.M.S. *Jaseur*, which has attained a speed of about 21 knots with forced draught. The third of the series of torpedo cruisers building at Barrow for the Admiralty, the *Niger*, is being rapidly completed, and will soon go on her sea trial to Gravesend. The troopship which is being built at Barrow for the Indian Office is now fully plated, and will be launched during the month of April. Among the other work which is proceeding at Barrow are three cargo steamers, all about 4,000 tons burthen, and a large steam yacht for Lord Ashburton. In the engineering department the engines have been completed for H.M.S. *Flora*, and there is plenty of activity in the building of the engines for about half-a-dozen steamers in course of construction at Barrow, in addition to the triple-expansion engines for two Clan Line steamers which are coming to Barrow for repairs. Generally, however, the prospects for new work are not so satisfactory as they have been, although in the meantime in the engineering and boiler-making departments there is plenty of work going on, and propably during the course of the spring and summer months new boilers will be placed.

Workington.—There is a quiet but steady trade in shipbuilding at Workington, but no new orders are reported. The yard here, however, is generally well filled with work, which is sold to owners either before or after launching in 64th shares.

Maryport.—There is a steady shipbuilding trade at Maryport, although operations are only on a comparatively small scale. Messrs. Ritson, who have just launched a vessel, have a barque on the stocks of 2,200 tons, and they are just putting down the keel for another large vessel.

Shipbuilding Material.—There is a fair but not brisk demand for steel shipbuilding material. Local makers cannot, however, compete at present prices. They are handicapped by dear coke, but they could fight against that, as they possess advantages in delivery which east coast makers do not possess. The great drawback at Barrow is that the plant is not constructed for economic working, and in the extra cost of labour alone there is a margin of 7s. to 8s. per ton. The plate mill at Barrow is one of the best in the world, but the arrangements of the Seimen's furnaces, the slabbing mill, and the heating furnaces are not such as to result in the economic manipulation of the work. Prices are easy at £5 for plates and £5 10s. for angles.

A New Industry.—The manufacture has been commenced, at Barrow, of steel barrels for the carriage of petroleum, in the place of wooden casks. The barrels are made in halves by the means of dies and compression while the thin plates of steel are hot. These halves are welded together by means of electricity, and the barrels, when produced, are to be used in the petroleum trade in hot climates. The new process is one possessing great interest, not only to those engaged in steel manufacture, but to those engaged in the shipping trade, and particularly the bulk petroleum trade.

"**Dr. C. M. Cumming,** Blackhill Dock, Glasgow, has contracted with the Inveraray Town Council to build a Steel Passenger Paddle Steamer for their traffic between Inveraray and St. Catherine's. Dimensions 65 ft. long by 13 ft. broad by 5 ft. 6 ins. mld. depth."

The Chapel Royal, Whitehall, now being altered for the Royal United Service Institution, is to be illuminated with electric light, which is being installed by the General Electric Power and Traction Co., Ltd., by order of the Council.

We understand that Messrs. T. A. Crompton & Co., Marine Engineers and Shipbuilding Contractors, have removed to more convenient and lighter offices at 86, Leadenhall Street, London, E.C.

THE MERSEY.

(From our own Correspondent.)

THE outlook generally remains without improvement, and the position continues very unsatisfactory throughout all branches of the engineering and iron trades of this district. There is no specially new feature to notice during the past month, business still dragging on in a hand-to-mouth sort of fashion, with a despondent tone prevailing very greatly with regard to the future. Marine engineers are securing no new work of any importance, and the shipbuilding industries on both sides of the Mersey remain in much the same position as last reported. In general engineering work there is, perhaps, some improvement, so far as stationary engine builders are concerned, some fairly good orders having recently been secured by one or two firms in this district, whilst one of the largest engine building establishments in Lancashire has work in hand which will keep them fully going for the remainder of the year. Boiler makers also are fairly off for work, a considerable weight of orders having come upon the market during the past month, and most of the Lancashire firms are just now tolerably well employed with work, although this has, in most cases, been taken at low prices. In locomotive and railway carriage building there has been more work stirring, but machine tool makers continue very indifferently supplied with orders, and it is exceptional where the shops in this district are anything like fully employed, many of them being only kept going by making for stock, whilst some of the principal works have recently been discharging a considerable number of hands. The returns issued by the Trades Union organisations as to the condition of employment show a slightly decreased number of out-of-work members on the books, but this has not come about by any increased activity in marine engineering or shipbuilding work, but by the slightly improved position of the one or two branches already referred to. The Amalgamated Society of Engineers have, however, still about eight per cent. of the membership in receipt of out-of-work support, and in the Steam Engine Makers' Society it is about four and a half per cent. of the total membership.

One or two of the local engineering firms have some special work in hand for marine engineering requirements, and Messrs. Wm. Muir & Co. have just completed an exceptionally powerful vertical milling machine, for a firm of marine engineers on the Clyde. Messrs. Muir & Co. are already well-known for tools of this class, but the one they have just completed is probably the most powerful machine of the above description that has been constructed. Altogether the machine weighs about 18 tons, and has a spindle 6 in. in diameter, driven by double gear, the cutter being about 4 in. in diameter by 12½ in. long, and is capable of taking a cut 1 in. deep, feeding at the rate of 1 in. per minute. The machine is designed for milling circular, straight, or general work, as well as coupling, connecting rod ends and cranks, and two tables are provided, the top one, which is 4 ft. square, with circular motion, being removable when the machine is required to operate upon exceptionally heavy work, the lower table being arranged to take in objects 3 ft. in height, under the jib of the machine. Another speciality is a very ingeniously designed double-acting system of ventilation, suitable for steamships, which has been patented by Messrs. James Evans & Co., engineers, of New Blackfriars, Manchester. In this arrangement air is drawn into a specially designed apparatus by means of a fan, when, after being passed through a filter, it can either be heated or cooled, as required. This apparatus, in its arrangement, very much resembles a miniature locomotive boiler, consisting of a number of internal tubes, surrounded by a jacket, the air passing through the intermediate space. Supposing the steamer were in a tropical climate, and the apparatus were required for refreshing the stifling berths and stokeholes, the tubes and jackets of the valves are supplied with cold water and refrigerating materials, and as the air passed through it could be reduced to any temperature required. On the other hand, in the case of steamships which pass from very hot climates to cold, the action of the apparatus can be immediately reversed, and by passing steam through the tubes and jacket, the air can be heated to such temperature as may be necessary for warming the ship. In addition to this double action it is also supplied with an arrangement for deoderising or disinfecting the air by means of a fine spray nozzle, supplied with disinfecting fluid, which is discharged into the air, as it passes from the fan before reaching the heater or cooler. The whole arrangement is very

compact, and requires but a small power for driving, so that it can be readily fitted up in any convenient position upon a steamship, and separate ventilators could be used for cabins, staterooms, stokeholes, &c. Messrs. Carnegie & Co. are in negotiation with Sir Joseph Whitworth & Co., of Manchester, for an exceptionally powerful press to be put down in their armour plate works at Homestead, and which it is stated is to enable them to manufacture larger steel forgings than any that have hitherto been produced, particulars of which I may be able to give next month.

In the iron market, business has been very slow all through the month, with a rather weakening tendency in prices, but with the close, if anything, the tone is steadier, makers evidently having got down to as low a point as they care to touch, and some of them, at the present unsatisfactory price, are not at all disposed to sell forward. Local brands of pig-iron have remained without quotable change, but some of the district brands have given way slightly, Lincolnshire not now averaging more than 41s. 6d. to 42s. 6d., with intermediate brands between Lincolnshire and Derbyshire about 43s. to 44s. and 44s. 6d. for forge and foundry, and Derbyshire foundry ranging, according to brand, from 45s. 6d. to 46s. 6d. and 47s., less 2½, delivered in this district. In outside brands, prices have, to some extent, been affected by the fluctuations in warrants, but they seem now to have got down to the bottom, and good foundry Middlesbrough could not be bought, anything under 42s. 10d., net cash, delivered equal to Manchester, with Scotch iron quoted at about 45s. for Govan and Eglinton, and 46s. 6d. for Glengarnock, net, prompt cash, delivered at the Lancashire ports.

Only a very limited amount of business has been coming forward in the steel trade as regards raw material. Hematites have, however, remained steady at about 54s. 6d., less 2½, but steel billets have got down to £4 5s., net cash, delivered in this district. In steel boiler plates there has been rather more business coming forward towards the close of the month, and makers are very firm at £6 10s. for leading qualities, delivered here, but the lower qualities of steel plates and other descriptions of manufactured steel continue extremely low.

The manufactured iron trade continues in an extremely depressed condition, and perhaps has never been in a worse position since 1886. None of the Lancashire forges are running full time, and several of them are not working up to half their full average production. Makers, however, still hold on to late rates, as—with the present cost — they are in most cases already unremunerative. Delivered in the Manchester district, good Lancashire bars are not quoted under £5 10s., with some special brands fetching £5 12s. 6d., but North Staffordshire bars now average £5 12s. 6d.; sheets are rather easier, Lancashire makes not averaging more than £7 to £7 5s., whilst in hoops, the Makers' Association have had to reduce their list rates 2s. 6d. per ton, random lengths being now quoted at £6, and special cut lengths at £6 5s., delivered in this district.

In the metal market, business has continued slow during the month, with no quotable change in list rates, which for delivery in this district remain as under :— Solid-drawn brass boiler tubes, 5¾d.; solid-drawn brass surface condenser tubes, 6¾d.; solid-drawn copper tubes, 7¼d.; brazed copper gas and steam tube, 7d.; brazed brass gas tube, 6¾d.; brazed brass machine tubes, 7d.; brass wire, 5¾d.; copper wire, 6¾d.; rolled brass, 5½d.; sheet brass, 6½d.; yellow metal bolts, 5¾d.; yellow metal condenser plates, 5¾d.; cast composition sheathing nails and spikes, 5¾d.; cast red metal sheathing nails and spikes, 7¾d.; wrought copper rivets, 8¼d.; wrought copper boat-nails, 8½d. to 9¼d.; wrought copper tacks, 11¼d. to 1s. 2¼d.; cut copper nails, 8d. to 9½d. per lb.; copper bolts, £61 per ton.

Business in the timber trade has been quiet, with imports generally only moderate. Prices remain unchanged, with stocks all round ample for the demand. There has been a moderate import of East India teak; but with fairly good deliveries stocks have been somewhat reduced, and prices are steady. There have been no arrivals of greenheart; and although the demand is at the same time only limited, the market has been firm, with stocks moderate.

In the coal trade there has been a steady slackening off in the demand generally, and it is very exceptional where pits have not had to go on short time, a great many of them not working more than three to four days per week. All descriptions of round coal are hanging upon the market; and the lower qualities, for steam and forge purposes, become, if anything, still more difficult to dispose of. Where business is done, prices are so subject to special arrangement that list rates are altogether nominal; but to move anything like quantities excessively low prices have to be taken, and for inland sale 6s. 6d. to 7s. would probably represent the full average figures that are obtainable. The shipping demand is even worse than the inland trade, and to secure orders still lower prices than those quoted above have been taken. A general absence of orders is the complaint at the ports on the Mersey, and steam coal for shipment is offered at 8s. per ton, delivered either at the Garston Docks, or the High Level, Liverpool.

HULL AND DISTRICT NOTES.

(From our own Correspondent.)

Hull.—It is so far satisfactory to be able to state that the shipping trade is tending in the direction of improvement. During the end of last month there was the largest outward tonnage during the present year, the total being fully double that of January and February. The increase is, of course, attributable to the opening of the lower Baltic ports after a very severe winter. Unfortunately there are still many steamers lying idle in our docks—new boats and old boats—wood and iron—good, bad, and indifferent—such a collection as has probably never been seen in Hull before. On the other hand, some of our shipbuilding yards are showing more activity.

Messrs. Cook, Welton & Gemmell have orders in hand for a dozen vessels, six of which are intended for trawling purposes, and will be built on the same lines as the "Hound" Fleet, others for the Hull Fishing and Ice Co., &c., screw tug for the Hull Dock Co., and a steam launch for H.M.'s Customs. Machinery for all these vessels will be supplied by local firms.

The steamship *Chieftain*, the latest addition to the Grimsby fleet of steam trawlers, built by Messrs. Cook, Welton & Gemmell, and engined by Messrs. C. D. Holmes & Co., of Hull, to the order of Mr. T. Robinson, Grimsby, has been taken on her trial trip. Leaving Grimsby she proceeded to the measured mile at Withernsea, where a speed of 9¾ knots was recorded. This vessel has been specially built for what is termed the inshore fishing, where the trips do not exceed six days, thus enabling the fishermen to be at home every Sunday, and avoid all Sunday work.

All the latest appliances have been fitted, and best arrangements made for the comfort and convenience of the captain and crew. After the run over the measured mile the owner and his officers expressed their satisfaction with both the ship and engines.

The steamship *Burton*, the latest addition to the Deddington Steamship Co., Limited, of Hull (Messrs. H. Samman & Co., managers), has lately undergone her official trial. She has been built by Edwards' Shipbuilding Co., Limited, of Howdon-on-Tyne, to Lloyd's highest class, and is 285 ft. long, 37 ft. beam, and 19 ft. moulded depth, and is fitted with all the latest improvements. The engines, by Blair & Co., Limited, Stockton-on-Tees, are 20½ in., 33½ in. and 55 in. diameter by 36 in. stroke, two boilers 12 ft. 6 in. diameter by 10 ft. 3 in. long, working at 160 lbs. pressure per square inch.

The weather was exceptionally fine, and after adjusting compasses, a continuous run of some hours, both with and against the tide was made, when it was found a speed of over ten knots per hour had been attained, the machinery working splendidly without the slightest hitch. This result was considered most satisfactory.

H.M.S. *Endymion* had her engines going again in dock last week, and electric lights tested preparatory to leaving for Portsmouth Royal Dockyard on the 7th inst. to go into dry dock there, before proceeding on her official trials previous to being handed over to the Admiralty.

Before these Notes are printed the various papers read at the meetings of the Institution of Naval Architects will have been discussed, and perhaps some reference made to the results of steam trials under both natural and forced draught of H.M.'s Fleet, and steamships of the Merchant Marine.

The committee appointed by the Admiralty, about twelve months ago, to report on existing types of machinery and boilers for H.M.'s ships has finished its work, and their investigations, along with the evidence of the various witnesses, has been printed in blue-book form, marked *confidential*, consequently all the valuable information obtained is considered to be of a private nature, and cannot be published for the benefit of the engineering profession, and garbled statements can only be obtained in

a *certain way*, or through some foreign intelligence department who are generally favoured with such information—although, as in this case—denied to the British public, who only have the privilege of paying the expenses of the committee for obtaining it. Surely the failures of several forced draught trials need not have deterred the Admiralty from publishing the report, seeing that about half of the committee had no official connections, who will therefore be enabled to make use of the information obtained at the country's expense for their own advantage. Such as proportions of machinery and boilers recommended not only for short periods at full power, but proportions also for continuous steaming at sea. Experience from the various witnesses as regards compound, triple, and quadruple-expansion engines, details of all kinds of marine boilers, as well as particulars of merchant vessels that have given satisfaction. Economy of feed heaters (if any) and the use of salt water for feed "make up," also the various opinions given both by the committee and witnesses as to the cause of *leaky tubes*, &c.

As to the personnel of the committee—sitting at the table might be seen a member of a firm of contractors who several years ago supplied the engines and boilers for one of H.M. ships—one of the boilers of which exploded when preparing for a trial of the machinery and scalded 76 men, 45 of whom died. Another member of the committee inspected the boilers after the explosion and stated that he found it hard to believe that the whole of the following circumstances should occur at one time, as appeared to have been the case, viz.:—The stop valve shut; the safety valve stuck fast; the pressure gauge out of order; and the combustion box weakened by the introduction of a 7-16ths instead of ½ in. plate; and in his opinion these boilers should not have been loaded to more than 9 lbs. instead of 30 lbs. per square in.

At the same table were representatives of the Board of Trade and Lloyd's. How could they reconcile their differences for, say, the working pressure of steel boiler shells of 29 tons tensile strength, 12·0 diam. by ⅞ thick, 80 per cent. joint with double butt straps; working pressure by B.T. 120·2 lbs., and by Lloyd's rules, working pressure only 111·1 lbs, and say a donkey boiler 5·0 diam. by 3-8ths thick, 70 per cent. joint, lap, and double riveted; working pressure by B.T. 118·4 lbs., and by Lloyd's rules, working pressure only 86·3 lbs.?

The time has surely arrived when some uniformity of practice might be accepted by all parties—Admiralty included.

"My Lords" (although their ways are sometimes strange and past finding out) may possibly condescend to examine this report, in order that all may be suitably rewarded; but seeing this hybrid committee was appointed during the time of the late Conservative Government, it was certainly expected that the present Government would have dealt with the valuable information thus obtained in a more *liberal* manner.

Lowestoft.—In the Notes for February, notice was taken of screwing down the safety valve of the capstan engine boiler of the fishing vessel *Lizzie*. News reached Lowestoft on the 20th ult. of a disastrous explosion, which occurred on board the Yarmouth fishing vessel *Fidget* in the North Sea, and resulted in the sinking of the craft and serious injuries to three of her crew. The *Fidget* was fitted with a steam capstan, with which the crew were preparing to heave the gear, when the boiler burst, and the deck was blown into the air. The master was terribly knocked about and blown overboard, but he was rescued by means of a rope, and he and two of his men were placed in a boat by their comrades, who pulled away from the *Fidget*, which had been completely wrecked by the explosion. They were picked up by a smack and taken to Yarmouth; the injured men being conveyed to the hospital. When last seen the *Fidget* was burning furiously.

Goole.—The annual meeting of the Goole Steam Shipping Co. was held at Goole on the 16th ult. From the report it appears that the gross profit amounts to £12,657, and to this amount has been added £2,609, the balance brought forward from the previous year. After deducting £2,100, the interim dividend paid in August last, and £8,015 for depreciation on steamers, floating plant, offices, &c., there remains £5,152 disposable. Out of this sum the directors recommended a dividend of 8 per cent. on the year's working, leaving a balance to be carried forward of £1,652. Notice was taken of bad trade and foreign competition, but under these circumstances the result was considered most satisfactory. The new steamer *Don*, of 1,100 ton burthen, was added to the company's fleet in August last.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Oscar II.—On March 1st Messrs. Wm. Gray & Co., Limited, launched a large steel screw-steamer which has been built to the order of Messrs. J. Christensen & Co., of Bergen, Norway. She will take Lloyd's highest class and is of the following dimensions, viz.:—Length over all, 327 ft.; breadth, 41 ft.; depth, 24 ft. The deck erections consist of long raised quarter-deck and partial awning deck, with large deck-house above. A handsome saloon, state-room, captain's room, &c., will be fitted up in the deck house amidships, and officers' accommodation will also be on deck, and the crew's berths forward. The hull is built with web frames, large hatchways are fitted, steam winches, steam steering gear amidships and screw gear aft, patent direct steam windlass, by Emerson, Walker & Co., two donkey boilers, cellular double bottom for water ballast, shifting boards throughout, two iron masts, boats on beams overhead, and a complete outfit will be provided for a first-class cargo boat. Engines on the three cylinder triple-expansion principle are being supplied by the Central Marine Engine Works of Messrs. Wm. Gray & Co., Limited. They will develop over 1,100 H.P. The cylinders are 23 in., 36½ in., and 62 in. diameter, with a piston stroke of 39 in., and five large steel boilers, having a working pressure of 160 lbs. per square inch. The ceremony of naming the vessel *Oscar II.* was gracefully performed by Miss Olsen, of West Hartlepool.

Caldy.—On March 2nd Messrs. Richardson, Duck & Co., launched from their yard, a steel screw steamer of the following dimensions:—Length over all, 327 ft.; breadth extreme, 41 ft.; depth moulded, 24 ft.; tonnage gross, about 3,000 tons. This vessel, which has been built to the order of Messrs. Farrar, Groves & Co., of London, under the supervision of John Crookston, Esq., Marine Superintendent, of London, will take Lloyd's 100 A1 class, and has been built under special survey. She is of the raised quarter and part awning deck type, with short half poop aft for accommodation of captain, officers, and passengers, engineers being berthed in a large deck-house abaft engine casing, and crew in forecastle. A cellular double bottom is fitted fore and aft, and her equipment includes five steam winches, large donkey boiler, steam steering gear, steam windlass by Emerson, Walker & Co., stockless anchors, and a complete system of electric lighting by Messrs. J. H. Holmes & Co. The engines, by Messrs. Blair & Co., have cylinders, 23 in., 38 in., and 62½ in. by 42 in. stroke, with two single-ended boilers, having a working pressure of 160 lbs. As the vessel was leaving the ways she was christened *Caldy* by Mrs. Groves, of Shirley Lodge, Shirley, Croydon, wife of one of the managing owners.

Skeffington.—On March 2nd there was launched from the shipbuilding yard of Messrs. Wood, Skinner & Co., at Bill Quay-on-Tyne, a steel screw steamer, built to the order of Messrs. John O. Scott & Co., Quayside, Newcastle-on-Tyne. The principal dimensions of the vessel are:—Length, 214 ft.; beam, 32 ft.; depth, moulded, 16 ft. 7 in. She has been built to the highest class at Lloyd's, and is constructed on the raised quarter-deck system, with cellular double bottom, all fore-and-aft, and will be rigged as a fore-and-aft schooner, with fidded topmasts, arranged for passing under the bridges of the Manchester Ship Canal. The cabins are arranged in bridge-house amidships, having accommodation for captain and officers. The accommodation for engineers is provided below the quarter-deck, aft, while the crew are berthed in the topgallant forecastle. The vessel is intended for the coal and general car trade, having as a special feature extra large hatches. She fitted with all the latest appliances for facilitating the rap loading and discharging of cargo. The engines, which are of the triple-expansion type, will be fitted by the North-Eastern Marine Engineering Co., Limited, of Wallsend-on-Tyne. The dimensions of the cylinders are as follows:—17½ in., 28 in. and 47 in. diameter, with a stroke of 33 in. The ship and engines during construction have been superintended by Mr. Alexander Taylor, of Newcastle-on-Tyne, on behalf of the owners. As the vessel left the ways she was named *Skeffington* by Mrs. John O. Scott, of Benwell. Captain Bishop, who has been long in the same service, is to take command of the ship when she is completed.

Westgate.—On March 2nd Messrs. T. Turnbull & Son launched at Whitby a steamer, which received the name of *Westgate*. The following are the particulars of the new vessel—Length over all, 321 ft. 9 in.; length between perpendiculars,

311 ft.; breadth, extreme, 40 ft. 6 in.; depth, to top of ordinary floors, 21 ft. 11½ in. She is classed 100 A1 at Lloyd's, and is built of steel. Her engines are by Messrs. Blair & Co., Stockton, and are of the direct-acting triple-expansion description, of 236 N.H.P. The cylinders are 23 in., 37½ in., and 61½ in.; length of stroke, 39 in. The deadweight carrying capacity of the *Westgate* is 4,200 tons, with Lloyd's freeboard. The *Westgate* has been purchased by Messrs. Turnbull, Scott & Co., London.

Iris.—On March 4th Messrs. Palmer's Shipbuilding and Iron Co., Limited, launched from their Howden yard a steel screw steamer of the following dimensions:—Length, 296 ft.; breadth, 39 ft.; depth moulded, 25 ft. 8 in. Her gross tonnage is about 2,345 tons. This vessel has been built to the order of the Societe Anonyme des Produits Resineux, of Antwerp, and has been built under the supervision of Mr. Schaeffer, of Newcastle, and Captain Muller, of Antwerp, and will receive the highest class at Bureau Veritas on completion. The vessel is of the spar-deck type, and is specially adapted for the carrying of oil and general cargoes. The engines are also built by Palmer's Shipbuilding and Iron Co., Limited, and are of triple-expansion type, with cylinders 22 in., 35 in., and 58 in., by 42 in. stroke, with two boilers having a working pressure of 160 lbs. As the vessel was leaving the ways she was christened by Miss Maud Thorman, and named the *Iris*. The vessel, after being launched, was taken across to the Jarrow side, where she will receive her machinery, and be rapidly equipped for sea.

Luciline.—On Saturday afternoon, March 4th, Messrs. Craig, Taylor & Co. launched from their Thornaby shipbuilding yard, Thornaby-on-Tees, a handsomely-modelled steel and iron tank steamer, having been built to the same model as s.s. *L'Oriflamme*, recently constructed by the same builders for the same owners, but with a somewhat different arrangement of tanks, two forward and two aft of engine-room, being carried to the spar-deck. Her dimensions are 343 ft. by 42 ft. by 28 ft.; depth, moulded, to spar-deck. She has a topgallant forecastle, long bridge and poop, triple-expansion engines by Mr. John Dickinson, Palmer's Hill Engine Works, Sunderland, with cylinders 25 in., 40 in., 66 in. by 45 in. stroke; two large double-ended boilers of Siemens-Martin steel, fitted with corrugated furnaces, and constructed throughout for a working pressure of 150 lbs. The machinery is fitted with all the latest improvements, and is placed amidships. The tanks and cofferdams have all been tested on the stocks to the entire satisfaction of Lloyd's and the owner's surveyors. The vessel is fitted with steam winches, steam steering gear, steam windlass, by Emerson, Walker & Co., steam heating and cooking arrangements, also telescopic masts; built to the highest class in Lloyd's. She is provided with a powerful set of pumps, also electric light by Messrs. Hayward, Tyler & Co., of London. A special fan and engine has been constructed by Messrs. Donkin & Nichol, of Newcastle, for ventilating purposes. She has been built to the order of Mr. John S. Barwick, of Sunderland, for Mr. Alfred Suart, of London, and under the superintendence of Mr. George Eldridge, of 88, Bishopsgate Street Within, London, E.C. As the vessel left the ways she was gracefully christened the *Luciline* by Mrs. W. Anderson, Mayoress of the new borough.

Phœnix.—On Monday, March 6th, there was launched from the Cleveland Dockyard of Sir Raylton Dixon & Co., of Middlesbrough, a steel screw steamer of the partial awning-deck type, which has been built to the order of Messrs. Hoyland & Co., of London, under the superintendence of Mr. Robert Eeles, of Newcastle-on-Tyne. The vessel has been constructed to secure Lloyd's highest class, the principal dimensions being:—Length, over all, 311 ft.; beam, 40 ft.; depth, moulded, 22 ft. 11½ in., and she will be capable of carrying about 4,000 tons all told. Triple-expansion engines will be fitted by Messrs. T. Richardson & Sons, of Hartlepool, having cylinders 24 in., 38 in., and 64 in. by 42 in. As the steamer was leaving the ways she was named the *Phœnix* by Mrs. E. A. Hoyland. As this vessel was only contracted for in November, and there has since been considerable interruption of work by Christmas holidays and bad weather, her construction has been very rapid.

Samara.—On March 6th there was launched from the Vectis Works of Messrs. William White & Sons, West Cowes, a steel steam yacht, which was named *Samara*, and which has been built to the order of Monsieur B. Vagniez, of Amiens. The dimensions of the yacht are:—Length on deck, 101 ft.; length on load water line, 93 ft.; beam, 16 ft. 2 in.; and depth, 9 ft. 2 in. She has been built to class 100 A1 at Lloyd's. The engines are of 37 N.H.P.

James Brand.—On Saturday, March 18th, there was launched from the Walker Shipyard of Sir W. G. Armstrong, Mitchell & Co., a large steel screw steamer, built to the order of Mr. Alfred Suart, of London, and intended for the carriage of petroleum in bulk. The vessel has been constructed on Swan's patent system, and to the highest classification of Lloyd's Registry. Her principal dimensions are:—Length, 352 ft.; breadth, 44 ft.; depth, moulded, 31 ft. She is capable of carrying over 5,000 tons deadweight on a moderate draught of water. For dealing with her cargo, she will have a complete pumping and piping installation. Her deck machinery is all supplied by Messrs. Clarke, Chapman, & Co., which firm will also fit the electric light installation throughout the vessel. The vessel was named the *James Brand* by Mrs. Tomlinson. After the launch, the vessel was taken to the works of the Wallsend Slipway and Engineering Co., where she will be fitted with triple-expansion machinery, embracing all the latest improvements. Amongst the company at the launch were Mr. Fowler, Mr. Denny, Mr. Eldridge, under whose supervision the vessel has been constructed; Captain Masters; Mr. Eeles, the owner's consulting engineer; Mr. H. F. Swan, director; Mr. Charles H. Reynolds, manager; Mr. and Mrs. E. L. Orde, &c.

Spondylus.—On March 18th Mr. James Laing launched at Sunderland a tank steamer, specially constructed for the bulk oil trade. The vessel, which is an excellent steamer of her class, was christened the *Spondylus* by Mrs. James Adamson, the wife of the honorary secretary of the Institute of Marine Engineers.

Tees.—On Saturday afternoon, March 18th, Messrs. Richardson, Duck & Co. launched from their building yard a finely modelled screw steamer for the Tees Union Shipping Co.'s new service between Stockton, Middlesbrough, Scarborough, and London, which has been specially designed to enter the harbour at Scarborough. She is of the following dimensions, viz.:—Length over all, 173 ft.; breadth, extreme, 26 ft.; depth, moulded, 13 ft.; gross tonnage, 550 tons. Water ballast is fitted in cellular double bottom and in fore and aft peaks. She has been built to class 100 A1 on Lloyd's Register under special survey, and to meet the requirements of the Board of Trade for a home trade passenger certificate. She has a long poop containing accommodation for 30 first-class passengers, officers, and crew; a topgallant forecastle for 20 second-class passengers, and has also accommodation for 50 third-class passengers. The accommodation for first-class passengers will be handsomely fitted up. There will be private cabins for ladies, the lavatory arrangements will be of a complete character, and the cabins and saloon will be heated by steam. A smoke-room is also provided on the poop deck. The comfort of passengers will be further enhanced by electric lighting fitted in saloon and all passengers' accommodation. The installation is by Messrs. J. H. Holmes & Co., of Newcastle, and also includes electric lighting for cargo, masthead, and side lanterns. The vessel will be fitted with all modern appliances for working the ship, and loading and discharging, including patent steam windlass, by Messrs. Emerson, Walker & Co., of Dunston-on-Tyne, and steam winches by Messrs. Roger & Co., Stockton. The engines are by Messrs. Blair & Co., of their triple-expansion type, cylinders 16½ in., 27 in. and 44 in. by 30 in. stroke, with boiler power for a working pressure of 160 lbs. The vessel was superintended during construction by Captain Battrum of the company's service. As she was leaving the ways she was gracefully christened the *Tees*, by Mrs. Arthur H. Appleton, of Preston-on-Tees.

Trefusis.—On March 18th there was launched from the yard of Messrs. John Readhead & Sons, West Dock, South Shields, a new steel screw steamer of the following dimensions:—Length, 298 ft.; breadth, 40 ft.; depth, moulded, 23 ft. 2 in. She is of the partial awning deck type, and is fitted with the latest improvements for loading and discharging cargo. The engines, also built by Messrs. Readhead, are on the triple-expansion principle, having cylinders 23 in., 37½ in., and 61½ in. diameter, by 30 in. stroke, steam being supplied by two large steel boilers working at a pressure of 160 lbs. per square inch. The steamer has been built to the order of Messrs. Edward Hain & Son, of St. Ives, Cornwall, and is the twenty-sixth vessel built by Messrs. Readhead for that firm. On leaving the ways the steamer was named the *Trefusis*, the christening ceremony being

performed by Miss Elsie Readhead, daughter of Mr. James Readhead.

Webster.—On Saturday, March 18th, Messrs. Wm. Gray & Co., Limited, launched a large steel screw steamer, which has been built to the order of the West Hartlepool Steam Navigation Co. She will take Lloyd's highest class, and is of the following dimensions, viz.:—Length over all, 336 ft.; breadth, 41 ft. 6 in.; depth, 24 ft. The deck erections consist of a hood aft with large deck-house on long raised quarter-decks, and partial awning deck forward. A handsome saloon and state rooms, together with the captain's room, will be fitted up in the deck-house aft, the engineers' accommodation amidships, and the crew's berths forward. The hull is built with web frames, large hatchways are fitted, four steam winches, steam steering gear amidships, and screw gear aft; patent donkey boiler, cellular double bottom for water ballast, and shifting boards throughout. Two iron masts with fore and aft rig, boats on beams overhead, and a complete outfit will be fitted for a first-class cargo boat. First-class engines, on the three cylinder triple-expansion principle, are being supplied by the Central Marine Engine Works of Messrs. Wm. Gray & Co., Limited. They will develop over 1,200 H.P. The cylinders are 24 in., 38 in., and 64 in. diameter, with a piston-stroke of 42 in., and five large steel boilers having a working pressure of 160 lbs. per square inch. The construction of the vessel and machinery have been under the superintendence of Captain Wright and Mr. Newton. The ceremony of naming the vessel *Webster* was gracefully performed by Miss Amy Barraclough, daughter of Mr. Thomas Barraclough, manager of the West Hartlepool Steam Navigation Co.

Hannah M. Bell.—On March 20th Messrs. Ropner & Son launched a steel screw steamer of the following dimensions, viz.:—Length between perpendiculars, 315 ft.; breadth, 40 ft. 6 in.; depth, moulded, 23 ft. 7 in. She will be classed 100 A1 at Lloyd's, and carry 4,450 tons deadweight on Lloyd's freeboard; she has raised quarter-deck and partial awning deck, cellular bottom for water ballast, and is built on the web frame principle, having all the latest improvements for a first-class cargo steamer. Her triple-expansion engines are by Messrs. Blair & Co., Limited, of 1000 I.H.P. with two large steel boilers working at 160 lbs. She has been built for the S.S. Hannah M. Bell Steamship Co., Limited, and the name of *Hannah M. Bell* was given to her by the lady after whom she is called.

Plympton.—On March 20th Messrs. Furness, Withy & Co., Limited, launched from their shipbuilding works at Hartlepool a large steel screw steamer built to the order of the Commercial Steamship Co., Limited, London. It is only a short time since these owners had a large steamer constructed at these works, and it is satisfactory to note that they have come back so soon with a repeat order. The vessel is a very substantial type of a modern cargo boat, measuring over 300 ft. in length, and built throughout of Siemens-Martin steel, with a large measurement and deadweight capacity, and built to the highest class at Lloyd's. Every care has been taken in designing this ship to construct her as substantial as possible for the heavy deadweight trade. She is built on the web-frame system, with cellular double bottom for water ballast all fore and aft, and subdivided at intervals, the after peak being also available as a tank. To further ensure the safety of the vessel the middle of the main and foreholds are divided by iron watertight bulkheads, these bulkheads being efficiently stiffened by an iron longitudinal division. It is anticipated that with the extra amount of subdivision in water ballast tanks and holds, with the efficient way the pumping gear is arranged, the vessel will be practically unsinkable by collision or stranding. To get as much strength as possible the greater portion of the shell plating is in 32 ft. and 24 ft. lengths, this plating being efficiently backed up by strong sectional framing carrying the strength to the top of the vessel all fore and aft, the topside plating being extra thick to withstand the heavy Atlantic trade, also the bottom plating is thicker in way of all ballast tanks to allow for the vessel lying aground whilst taking in cargo. To allow for corrosion the whole of the weather decks, tank tops, floor plates, &c., are of extra thickness, there being practically no thin steel in the ship. She has extra large-sized hatchways, which will take the bulkiest description of cargo, and would be especially suitable for carrying machinery, large guns, torpedo boats, &c. A new design of bilge intercostal keelson is fitted in the holds (Sivewright's patent). By this new arrangement very much of the dunnage and damage to bag cargo is avoided, there being no pockets or receptacles for loose grain, coals, dirt, &c., consequently these keelsons can be much more rapidly cleaned down when discharging cargo. A very good arrangement in connection with the vessels built for this firm is the care taken in housing the officers, engineers, &c. So as to get good ventilation in hot climates, this accommodation is put on deck in two large deck-houses, one at the fore part of the engine-room and the other at the after end of the bridge. The quarters are very cool and comfortable, and one great advantage in connection with the same is that in the heaviest weather all the officers are able to be close to their work. This system of deck-houses, introduced by Messrs. Furness, Withy & Co., has worked so well that it is now becoming universal. The auxiliary machinery for working and discharging cargo is of the most efficient description—large winches to hatches, patent steam steering gear amidships, with hand gear aft, steam windlass, and the anchors being of the stockless pattern, these can be stowed into the hawse pipes, and the whole operation of catting and lifting the anchors can be done by one man in a few minutes. The vessel will be rigged as a polemasted schooner. The machinery has been constructed by the well-known engineers, Messrs. Blair & Co., Limited, Stockton-on-Tees. She will have two single-ended boilers worked with high pressure steam. Every provision has been taken in designing the machinery to get it built of the most substantial character for the heaviest trading. It is anticipated that a good speed will be attained by this vessel, as she is finer lined than the ordinary run of cargo boats. The hull and machinery have been constructed under the supervision of Mr. E. T. Jones, superintendent for the Commercial Steamship Co. On leaving the ways the vessel was gracefully christened *Plympton* by Mrs. G. W. Sivewright, of Hartlepool.

Falken.—On Tuesday afternoon, March 21st, Messrs. Craig, Taylor & Co. launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, a steel screw steamer of the following dimensions:—244 ft. by 34 ft. by 17 ft. 9 in. depth, moulded. The vessel is built with a long raised quarter-deck, bridge and top-gallant forecastle, and to the highest class in Lloyd's. She is on the web-frame principle, and has cellular bottom fore and aft for water ballast. Her engines are by the North-Eastern Marine Engineering Co., Sunderland, and are of the following sizes:—18½ in., 30 in., and 49 in. by 33 in. stroke. Two steel boilers 160 lbs. pressure. She is fitted with four steam winches, steam windlass, and steam steering gear, and all the latest improvements so as to fit her for her intended trade. The vessel has been built to the order of Consul Axel Georgii, Esq., for the Rederiaktiebolaget "Condor," of Stockholm, and under the superintendence of Captain Alex. Von Björnmarck, who will take command of the vessel. As she left the ways she was gracefully christened the *Falken* by Miss Clark, daughter of Councillor Clark, West Hartlepool.

Steel Ship.—On Tuesday, March 21st, Messrs. Ritson & Co. launched from their shipyard at Glasson, Maryport, a three-masted steel ship of the following dimensions:—Length, 268 ft.; breadth, 40 ft. 1 in.; depth, 23 ft. 6 in., and a deadweight carrying capacity of 3,200 tons. The new ship has a round overpoop for captain, officers, and passengers, and two deck-houses, one for the apprentices and petty officers, and the other for the crew. She is provided with a steam winch and boilers, topgallant forecastle, double-purchase capstan, and is fitted up with all modern improvements. The cabin is beautifully furnished in American walnut and bird's-eye maple with cushions Utr cht velvet and Brussels carpet.

LAUNCHES.—Scotch.

Hound.—On March 1st, the Fairfield Shipbuilding and Engineering Co., Limited, launched from their yard at Govan the steamer *Hound*, a vessel constructed by them to the order of Messrs. G. & J. Burns, and intended for that firm's accelerated mail service between Ardrossan and Belfast, on which she will run in conjunction with the s.s. *Hare*. The new vessel resembles in many respects the well-known Greenock and Belfast steamers of Messrs. Burns, is constructed throughout of steel to the requirements of Lloyd's A1 class under special survey, and measures 250 ft. by 32 ft. by 16 ft. 3 in. moulded. She is schooner rigged, and has a long full poop bridge and topgallant forecastle, with high bulwarks between. A large deck-house on the poop encloses the entrance to the first-class accommodation, two spacious private cabins and a first clas smoking-room. A

house is also fitted at forward end of bridge deck containing captain's cabin, surmounted by the navigating bridge. The first-class accommodation includes, in addition to the customary sleeping accommodation, a spacious saloon and all the necessary pantries and other facilities. Under the topgallant forecastle is provided accommodation for steerage passengers, while underneath, on lower deck, are the rooms of the officers, engineers, stewards, firemen and crew. The galley with cooking apparatus is in the casings on bridge deck, below which the space is arranged for carrying horses and cattle. The propelling machinery is of the usual triple-expansion type with three cylinders, 26 in., 42 in., and 68 in. diameter, with a stroke of 3 ft. 6 in. The cylinders are all steam-jacketed, and fitted with separate liners, the high-pressure cylinder being fitted with a piston valve, and the others with the usual double-ported slide valves. The valves are worked by double eccentric link motion, and the reversing is accomplished by a steam and hydraulic reversing engine. In addition there is the usual hand gear. The crank shaft is in three sections, each being built, and, with the other shafting, is forged of mild ingot steel. Steam is supplied by two double-ended boilers, each containing six corrugated furnaces and working at a pressure of 165 lbs., constructed to the Board of Trade and Lloyd's requirements. A Weir's feed-water heater, with necessary pumps, is fitted in the engine-room, also an independent donkey for pumping out the ballast tanks. The vessel is fitted with all the more modern appliances, including a full installation of electric light, steam steering gear, a steam capstan on the forecastle head, and a steam winch at each cargo hatch. Boats and life-saving appliances are also provided to Board of Trade requirements. The launching ceremony was gracefully performed by Mrs. George Arbuthnot Burns.

Vanland.—On March 2nd the Campbeltown Shipbuilding Co., launched from their yard at Campbeltown (Clyde), a handsomely modelled steel screw steamer of 1,950 tons deadweight. The engines, which are triple-expansion, have been supplied by Messrs. Kincaid & Co., Limited, Clyde Foundry, Greenock. The steamer has long raised quarter-deck aft, and partial awning deck forward, water ballast in cellular double bottom, complete and speedy pumping arrangements, steam and screw steering gears, supplied by Messrs. Higginson & Co., Liverpool, and Hastie, Greenock. All the latest improvements for navigating the ship economically, and for the speedy loading and discharging of cargo, including large steam winches. Steam will be supplied by suitable boilers working at a pressure of 160 lbs. It is expected an average speed of 9½ knots loaded at sea on a moderate consumption of fuel will be attained. The vessel has been built to class 100 A1 at Lloyd's, under special survey for the Angfartygs Aktiebolaget Svithiod, of Gothenburg, and is intended for their trade between Gothenburg and Liverpool. Captain C. von Below, who is to take command of the vessel, has superintended her completion. The steamer was gracefully named *Vanland* by Miss Lizzie Colville, The Hall, Campbeltown.

Turquoise.—On March 4th Messrs. John Shearer & Son launched from their yard at Kelvinhaugh the screw steamer *Turquoise*, of about 500 tons, built for Mr. Wm. Robertson, Glasgow. The engines will be constructed by Messrs. Walker, Henderson & Co., Glasgow.

Vulcan.—On March 4th Messrs. Barclay, Curle & Co. Limited, of Whiteinch, launched a powerful twin-screw steam-tug for Southampton, Isle of Wight, and South of England R.M.S.P. Co., Limited. Dimensions: Length, 120 ft.; breadth, 25 ft.; depth, 12 ft.

Auldgirth.—On March 6th Messrs. Russell & Co. launched at Port-Glasgow the *Auldgirth*, a three-masted sailing barque, built to the order of Messrs. Guthrie, Macdonald, Hood & Co., Glasgow. The *Auldgirth* is a vessel of 1,500 tons register, and has a carrying capacity of 2,560 tons. Her dimensions are—Length, 242 ft.; breadth, 37 ft. 6 in.; and depth, 22 ft. 6 in. The vessel is to replace the *Minnyhive*, of the Village Line, recently lost.

Bonito and Dolphin.—On March 6th Messrs. J. McArthur & Co. launched at Paisley two steel screw steamers, named *Bonito* and *Dolphin*, which have been built to the order of Messrs. Paton & Hendry, 2, Oswald Street, Glasgow. Engines of compound surface-condensing type are being fitted by Messrs. Bow, M'Lachlan and Co., Paisley.

Micmac.—On March 8th there was launched from the shipbuilding yard of Messrs. Charles Connell & Co., Scotstoun, a steel screw steamer of about 2,500 tons register, for Messrs. J. W. Carmichael & Co., Nova Scotia. She has been built to the highest class in Lloyd's registry to the plans and specifications of Mr. George M'Farlane, naval architect and consulting engineer, 24, George Square, under the superintendence of the owners' representative, Captain Meikle. As the vessel left the ways she was named *Micmac* in the customary manner by Miss Meikle, Blairburn Villa, Helensburgh. The engines are being fitted by Messrs. Dunsmuir & Jackson, Govan.

Princess Beatrice. — On March 8th Messrs. D. & W. Henderson & Co. launched from their shipbuilding yard at Meadowside, Partick, a handsome steel screw steamer built to the order of Messrs. M. Langlands & Sons, of Glasgow and Liverpool. The vessel, which is intended for their popular service between Leith and Liverpool, *via* the North of Scotland, has accommodation for a large number of saloon passengers. She is lighted throughout by electricity, is fitted with all the latest appliances for handling cargo, and has been specially designed with a view to trading from Manchester on the opening of the ship canal. Her principal dimensions are:—Length, 245 ft.; breadth, 34 ft.; depth from main deck, 16 ft.; and she has been built under special survey to highest class of Lloyd's. As the vessel left the ways she was gracefully christened *Princess Beatrice* by Mrs. Ralph R. Langlands.

Susu.—On March 8th Messrs. William Hamilton & Co. launched at Glasgow a steel screw steamer of 190 tons register, named *Susu*, built to the order of Messrs. Fisher & Randall, Limited, Manchester. The engines will be supplied by Messrs. David Rowan & Sons, Glasgow.

Clunies Ross.—On March 9th Messrs. T. B. Seath & Co. launched from their yard a handsome steel sailing yawl for Mr. G. Clunies Ross, of the Cocus Keeling Islands, Southern Indian Ocean. She has been built to class in Lloyd's yacht register, and is intended for the owner's private use in the furtherance of his duties as proprietor and governor of these islands. As the vessel left the ways she was named the *Clunies Ross*. The christening ceremony was gracefully performed by Mrs. James Connell, of Viewbank, Bearsden.

London Belle.—On March 10th Messrs. William Denny & Bros. launched at Dumbarton a fast paddle steamer of 700 tons gross for the London, Woolwich, and Clacton-on-Sea Steamboat Co., Limited. The steamer will be fitted up with all the latest improvements, including steam windlass and steam steering gear, a large deck saloon the full width of the ship for first-class passengers, dining-saloon below main deck for first and second-class passengers, and a large promenade deck extending from foreside of bridge to stern over the deck saloon. As the vessel left the ways she was named the *London Belle*, by Miss Penfold, daughter of the chairman of the company. The *London Belle* is intended for the passenger trade between London and Clacton-on-Sea.

Gundreda.—On the afternoon of March 16th there was launched from the yard of Messrs. Ramage & Ferguson, Limited, a steam yacht of about 380 tons, built to the order of H. J. Barrett, Esq., Langford Park, Maldon, Essex. This is the second yacht built by the above firm for Mr. Barrett, her principal dimensions being 166 ft. by 22 ft. by 14 ft. 6 in. m.d., and is fitted with triple-expansion engines having cylinders 15 in. by 24 in. by 39 in. by 24 in. stroke, supplied with steam from a large single-ended steel boiler, working at 160 lbs. pressure. The cabin arrangements are very complete and elegant, being fitted to special artistic designs in rare polished woods, while all other conveniences and appliances are of the latest and most improved description. On leaving the ways the yacht was named *Gundreda* by Miss Allison, Moray Place, Edinburgh.

Emily.—On March 17th Messrs. John Fullerton & Co., Paisley, launched a steel screw steamer of about 230 tons, which has been built to the order of a Cardiff firm for their local carrying trade. Compound engines of 51 N.H.P. will be supplied by Messrs. Ross & Duncan, Govan. The steamer was named the *Emily* by Mrs. David Lamb.

Archibald Finnie.—On March 21st Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley, launched a steel screw steamer, having dimensions of 175 ft. by 26 ft. 6 in. by 13 ft. She is to be fitted with a set of the builders' patent quadruple engines, to indicate 1,000 H.P., to drive her a loaded speed of 12 knots. This steamer has been built to the order of Messrs. Archibald Finnie & Son, Kilmarnock, and is to be employed by them in their coasting trade between Scotland and

Ireland. The christening ceremony was performed by Miss Finnie, of Springhill, Kilmarnock, and the vessel was named the *Archibald Finnie*, in memory of the late Provost Finnie, of Kilmarnock.

London City.—On March 21st the largest steamer for purely cargo purposes yet built on the Clyde was launched from the Shipbuilding and Engineering Works of Messrs. Alex. Stephen & Sons, Linthouse. She is a handsome schooner rigged steel screw steamer of about 5,000 tons gross register. Her dimensions are: Length, 400 ft.; breadth, 48 ft.; depth moulded, 31½ ft. The deck erections consist of short poop, bridge-house, and topgallant forecastle. The vessel has been constructed to Lloyd's highest class of 100 A1 spar deck rule, under special survey, and has two complete iron decks, but instead of hold beams extra heavy main framing and longitudinal intercostals have been substituted, thus leaving large unobstructed holds for stowage of cargo of the bulkiest description, and as the vessel has four very large hatchways, she is well adapted for taking exceptionally large pieces. She has a cellular double bottom for water ballast, and is fitted with steam and hand steering gear, steam winches, steam windlass, and all the most efficient appliances for the economical and rapid handling of the ship and cargo. The saloon and state-room accommodation for captain and officers in the bridge-house is fitted up in a chaste and comfortable manner, while the crew are located as usual in the forecastle. The engines, also constructed by Messrs. Stephen, are of the most improved triple-expansion type, having cylinders 26 in., 41 in., and 67 in. diameter, by 48 in. stroke. The boilers are of the double-ended type, and are designed for a working pressure of 160 lbs. per square inch. The ceremony of naming the vessel *London City* was performed by Mrs. A. E. Stephen, 9, Princes Gardens. The *London City* has a deadweight capacity of about 7,200 tons; while her measurement capacity for cargo is equal to no less than 9,500 tons of 40 cubic feet to the ton.

Nile.—On March 21st a fine steel screw steamer, of about 6,000 tons, built for the Royal Mail Steam Packet Co., was launched by Messrs. James & George Thomson, Limited, Clyde Bank. The vessel, which is the first of two Messrs. Thomson are building for the company, is specially designed for the first-class mail and passenger service between Southampton, Brazil, and the River Plate. Her length between perpendiculars is 420 ft.; breadth, 52 ft.; and depth, moulded, 35 ft. 5 in. She is built of steel, under special survey to the highest class at Lloyd's, and her hull is divided into eleven compartments by ten water-tight bulkheads, which meet in every respect the requirements of the Board of Trade. She will also be available for chartering by the Admiralty in time of war. On the main, upper, and promenade decks there is accommodation for 215 first-class and 36 second-class passengers, and on the main and lower decks for 350 emigrants. The first-class saloon, a large and airy apartment, with dining accommodation for 107 persons, is situated on the upper deck forward of the machinery. It is lighted by large pivoted side-lights and by the central skylight over the music-room on the promenade deck. Abaft the music-room is a ladies' saloon, and further aft on the same deck, but with a separate entrance, a large smoking-room: while below the dining-room on the main deck is a smaller saloon, with accommodation for 69 persons. The whole of these apartments will be luxuriously fitted and upholstered. The first-class state-rooms, which extend almost from end to end of the ship on the main deck, are unusually roomy, and their fittings are of the most modern kind. The second-class saloon is on the upper deck under the poop, with the second-class state-rooms on the main deck immediately below, and a smoking-room on the poop deck above. The whole of the poop deck is reserved for second-class passengers, while the promenade deck amidships for 140 ft. is set apart for the use of the first-class. This deck along its whole length is covered by a light shade deck which protects the passengers from rain or the sun, and at the same time serves to accommodate the 14 boats which the vessel carries. There will be a complete installation of electric light by the builders' own electrical staff. The appliances for handling cargo are of the most modern kind, and include six hydraulic cranes, two hydraulic derricks, two steam cargo winches, and a hydraulic winch for hoisting in the boats. The windlass and steering gear are worked by steam, and the latter is connected with the bridge by a hydraulic telemotor. Refrigerating machinery is provided, with large cold-air chambers and ice-making plant The engines are of the ordinary inverted direct-acting triple-expansion type, and steam is supplied by four large double-ended steel boilers. The machinery is designed to give a high rate of speed. As the vessel left the ways she was gracefully named by Miss Curtis.

Havila.—On March 22nd there was launched from the shipbuilding yard of Messrs. A. M'Millan & Son, Limited, Dumbarton, a finely-modelled steel barque of about 1,350 tons register, named the *Havila*. The vessel has been built for Captain Mortensen, of Fane, Denmark, by whom she has been superintended, and who will command her when completed. The christening ceremony was performed by Mrs. Mortensen.

Eureka.—On March 23rd, Messrs. William Hamilton & Co., Port-Glasgow, launched from their Newark yard a steel screw tug, named *Eureka*, of 170 tons, specially constructed for towing purposes on the river St. Lawrence. Dimensions:—Length, 95 ft.; breadth, 22 ft.; depth, 12 ft. 6 in. This vessel is built to the order of Messrs. Connolly, Montreal, and will be supplied with machinery by Messrs. David Rowan & Sons, Glasgow. The ceremony of naming the vessel was gracefully performed by Miss Florence Nightingale, Broadfield, Port-Glasgow.

Inverlyon.—On March 23rd Messrs. Russell & Co. launched from Kingston Yard, Port-Glasgow, a three-masted steel sailing barque of 1,300 tons register, to carry 2,400 tons deadweight, for Messrs. George Milne & Co., Aberdeen. Dimensions:—Length, 238 ft.; breadth, 36 ft.; depth, 21 ft. 9 in. The vessel, which is named *Inverlyon*, was built under the superintendence of Captain Leslie, Aberdeen, and will receive her outfit in James Watt Dock.

Gulnare.—Messrs. Charles Connell & Co. launched from their shipbuilding yard, at Scotstoun, the steel screw steamer *Gulnare*, which they have built to the order of Captain Alexander MacLeod, Prince Edward Island. This smart little vessel is built to the highest class in Lloyd's and is specially designed for employment in the Admiralty Survey on the Canadian coast under charter by the British Government. The accommodation is of the most complete description, and has been arranged to the designs of Staff-Commander Tooker, R.N., who has charge of the Survey. The whole vessel has been carefully arranged and finished in the best possible manner for the special work she is to be engaged in, and will be commanded by Captain Alexander MacLeod, jun. Messrs. Dunsmuir & Jackson are supplying the engines, which are expected to develop a good rate of speed. As the vessel left the ways she was christened in the customary manner by Miss Daisy Kelso, daughter of Mr. James Kelso, Huntly Gardens. This is the third steamer Captain MacLeod has got built by Messrs. Connell & Co. for this service, the two former ones being of composite construction.

LAUNCHES—Irish.

Sophie Kirk and Jeanie Woodside.—On March 2nd there was launched at high water from the shipyard of Messrs. Workman, Clark, & Co., Limited. Two handsomely modelled steel sailing barques, to the order of Messrs. W. J. Woodside & Co., shipowners, Belfast. The first vessel launched was the *Sophie Kirk*, the christening of which was gracefully performed by Miss Kirk, of Potterswalls, Antrim. The other, which followed shortly after, was gracefully christened the *Jeanie Woodside* by Miss Woodside, of Baunmore Whitehouse, daughter of the owner. This vessel is the ninth built for Messrs. Woodside & Co. by the firm, and celebrates the century of launches from the yard. The principal dimensions of the barques are:—Length, 211·7 ft.; breadth, 35·3 ft.; depth, 17·2 ft.; registered tonnage about 900; and they have been specially designed for a large carrying capacity on a light draught of water. The vessels have been built to class 100 A1 at Lloyd's, under special survey. Both have full poop, topgallant forecastle, and large deck-house amidships, and are sister vessels in every respect The three hatches with which they are provided are extra large, and all equipped with winches for the efficient working of cargo. The main hatch has been designed with the view of shipping large pieces of machinery and boilers, while the hold forward, is left clear for the stowage of these by fitting of web frames, a rather unusual practice in sailing vessels, and the hold beams are widely spaced, leaving a practically unobstructed space for large cargo. The main hatch is worked by a steam winch, placed in the after end of midship house, while a derrick is fitted for lifting in heavy loads. In the fore part of the house accommodation is provided for the crew, and

the galley is fitted up between this and the donkey boiler-house. Under the topgallant forecastle, side-houses are fitted, containing rooms for the carpenter, cook, paints, lamps, &c. The poop is fitted up for the accommodation of the captain, officers, &c. The saloon is handsomely panelled in polished grey maple, with mouldings and stiles of walnut, and upholstered in Utrecht velvet, while the room for the captain is fitted up in polished walnut and cedar, and finished similarly to the saloon. The officers and steward have each a comfortably furnished room at sides of vessel. A mess-room has been provided for the use of the officers, situated in the fore end of the poop. The remainder of the space is fitted up as sail-room, bath and w.c., store-room, pantry, &c., while on a deck below the cabin, a large lazarette contains the bread tanks and ship's stores. The windlass is one of Emerson & Walker's patent, with capstan combined, and can be worked by messenger chain from the steam winch as well as by hand power. A capstan for warping purposes is placed on the main deck aft. The masts, bowsprit, lower yards, and both topsail yards are all of steel, and as the barques are to have fast sailing qualities, the spars are lofty, and the sail spread very large, enabling the vessels to make quick passages with upwards of 1,600 tons deadweight on 16 ft. draught. The workmanship and material throughout are of the best quality, and the vessels will be completely fitted out.

Orcana.—On March 7th, Messrs. Harland & Wolff launched the s.s. *Orcana* from the south end of the Queen's Island shipyard. This vessel, which is built for the Pacific Steam Navigation Co., has a gross tonnage of 4,820, and is sister ship to the *Orellana*, launched early in December last, both being intended for the company's line of mail steamers running between Liverpool and the western ports of South America. The state-rooms for first-class passengers will be placed amidships on the boat deck, bridge deck, and upper deck. The saloon will be on the upper deck, and a luxurious drawing-room on the boat deck. Third-class passengers will also be carried, accommodation for them being fitted up on the middle deck. Liberal provision will be made for the comfort of all the passengers, and the electric light will be fitted throughout the vessel. The triple-expansion engines, which are of 3,000 I.H.P., have also been constructed by Messrs. Harland & Wolff. The propeller will be of manganese bronze. Mr. Hugh Brown was present at the launch on behalf of the owners.

Goth.—On March 16th the Union Steamship Co.'s new steel twin-screw steamer *Goth*, which has been built for their service to and from South Africa, was launched from Messrs. Harland & Wolff's yard, at Belfast. This is the second of the three steamers building for the company by this firm, the first, the *Gaul*, having been launched on 16th February —for description, see March number—and the construction of which vessels mark a new departure in the policy of the Union Steamship Co. The *Goth* is identical in dimensions, &c., with the *Gaul*. Her gross tonnage will be about 4,830, and she will be propelled by manganese bronze twin screws, driven by two sets of triple-expansion engines, developing an I.H.P. of about 2,000. The *Goth*, while providing a very large carrying capacity for cargo, on a light draught of water, will have unusually complete passenger accommodation for first, second, and third class passengers, all of whom will be carried on the upper deck. She will be specially fitted with every convenience, including electric light, refrigerator, and cold chambers for the conveyance of fruit. Under ordinary circumstances, it is anticipated that the *Goth* will cross the bars at East London (Cape of Good Hope) and Durban (Natal), and land passengers and goods direct on to the wharves. The third vessel, the *Greek*, which will be similar in all respects to *Gaul* and *Goth*, will be ready for launching in May.

Moya.—On March 16th, at high water, there was launched from the shipbuilding yard of Messrs Workman, Clark & Co., Limited, Belfast, a steel twin-screw steamer built for the Commissioners of Irish Lights. The christening ceremony was gracefully performed by Miss Galway, daughter of Captain Galway, Dublin, who named the vessel the *Moya*. The dimensions of the vessel are :—Length, 126 ft.; breadth, 28 ft.; depth, moulded, 11 ft. 7 in., and she has been built to Lloyd's highest class and with Board of Trade passenger certificate. The *Moya* has been specially designed to suit the requirements of the Commissioners' service in attending some of the lighthouses on the south-west coast of Ireland. The vessel has been strengthened considerably over Lloyd's requirements. The after part of the vessel has been set apart as the cabin for the accommodation of the master, engineers, &c., each having a separate state-room. The saloon is handsomely panelled in polished walnut and upholstered in leather cloth. The seamen, firemen, &c., are berthed in the forecabin, which also contains four rooms fitted up as cabins for the conveyance of the lighthouse keepers. A bridge deck extends over the machinery space, having a wheel-house at the front. The boats are housed on this deck, and are fitted with patent disengaging gear. Under the bridge in side houses are the galley, lamp-room, and w.c. Protection is afforded the fore end of the vessel from heavy seas by a turtle-back forecastle extending about 20 ft. from the stem. On this deck the anchors are placed, being worked by Emerson, Walker & Co.'s patent capstan windlass by means of a crane on deck. The engines are two sets of compound direct acting, with cylinders 16 in., 30 in. by 18 in. stroke, and one large steel boiler. The propellers are three-bladed and made of manganese bronze. The machinery has been constructed by Messrs. Workman, Clark & Co., Limited, Engine Works, Queen's Road. The *Moya* has been specially designed and built under the superintendence of Mr. Wymer, of the Board of Trade, and Captain Galway, Inspector of Irish Lighthouses. After the launch the vessel was towed to the crane to receive her machinery, and the vessel will shortly be completed and ready for the Commissioners' service.

Maria.—On Saturday, March 18th, there was launched from the shipbuilding yard of Messrs. MacIlwaine & MacColl, steamer 302 ft. long, 41 ft. beam, and 21 ft. deep. The vessea which is the second built by the firm for the same owner, isto the order of Mr. A. Embirioos, of Braila, and was named *Maria* by Miss MacColl. She was at once taken in tow and berthed in the Abercorn Basin to receive her machinery and outfit, and it is expected that she will be delivered within the next few weeks The hull and machinery are to the specifications of the owner's consulting engineers, Messrs. William Esplen & Son, Liverpool. The engines are of the builders' triple-compound type, having cylinders 23 in., 37 in. and 60 in. diameter, operating on three cranks; the boilers being of steel, loaded to 165 lbs.

LAUNCHES—American.

Indiana.—On February 28th this United States battleship was launched from Messrs. Cramp's yard, Philadelphia. She is the first American battleship completed, and is the longest vessel in the American Navy. Her dimensions are :—Length, 348 ft.; breadth, 69¼ ft.; depth, 24 ft. draught. Her displacement is 10,298 tons. She has an I.H.P. of 9,000, and is equipped with a main battery of four 13-in., eight 8-in., and four 6-in. breechloading rifled guns, and armour-plates of Harveyised nickel-steel 18 in. in thickness on the sides and 17 in. on the turrets. Her speed is estimated at 15 knots, and her cost at over 3,000,000 dols.

Katahdin.—The *Katahdin*, a ram built for the United States Navy, has lately been launched from the Bath Iron Works, Maine. The *Katahdin* is built throughout of steel, and is of the following dimensions:—Length over all, 251 ft.; extreme breadth, 43 ft. 5 in.; extreme depth, 21 ft.; normal draught, 14 ft. 11 in.; fighting draught, 15 ft. 5 in.; displacement at latter draught, 2,240 tons. The hull is built upon the bracket system, and has a double bottom extending from the forward collision bulkhead to the stern The longitudinals and girders supporting the deck are continuous to the stem and stern. The space between the two bottoms is divided into 72 watertight compartments, while there are 30 compartments in the body of the vessel between the inner body and the deck, thus making a total subdivision into 102 watertight compartments. The vessel lies very low in the water, in order that the ram, after striking, may continue its destruction by tearing or cutting through the enemy's sides. The total cost of the *Katahdin* will be about £187,000. She is to be fittted with two triple-expansion engines propelling twin crews. Her contract speed is 17 knots per hour.

LAUNCHES.—German.

Hebdomos.—On February 10th the Flensburg Shipbuilding Co. launched a new steel screw steamer with following dimensions :—240 ft. by 34 ft. by 17 ft. The steamer is built for the Flensburg Steamship Co. of 1869, and will trade in the Baltic.

Electra.—On March 2nd a sister ship built for Messrs. Holm & Molzen was launched from the same yard.

TRIAL TRIPS.

Northern Light.—On February 15th this ship, built by the Naval Construction and Armaments Co., of Barrow, was taken for trial at sea. She is the first steamer designed for the conveyance of petroleum in bulk which has been constructed in Lancashire, and has been ordered by Messrs. Lane & Macandrer, of London, and built under the inspection of their consulting engineers, Messrs. Flannery, Baggallay & Johnson, of London and Liverpool. Her leading dimensions are:—Length, 347 ft.; breadth, 45 ft. 6 in.; depth, 28 ft. 6 in. She has 14 tanks for conveyance of oil, two holds for general cargo, and six tanks for water ballast, one of which can be used for storage of water for main boilers when needful. She is fitted throughout with electric light, powerful pumping apparatus, capable of dealing with about 400 tons of cargo an hour, and steam ventilating apparatus. Her engines, by the same builders, have cylinders 26 in., 42½ in., 69 in. and 45 in. stroke, taking steam at 160 lbs. pressure from three large boilers, capable of maintaining a full head of steam when running at full speed. She also carries two auxiliary boilers for purposes of cargo and ballast. Her trial proved in every respect thoroughly satisfactory, two runs of about one hour each being made in opposite directions. The mean speed as observed over a known distance being fully 12½ knots, with rather more than 5,000 tons of deadweight on board, the whole of the machinery working without the slightest hitch. The vessel handled easily and well, and the whole of the auxiliary machinery, which is considerable in vessels of this type, was also thoroughly tested.

Cromer.—On February 24th the *Cromer*, a vessel of 450 tons carrying capacity, built by Messrs. Anderson & Laverick, Mushroom, Newcastle, and engined by Messrs. Hedley & Boyd, Low Lights, North Shields, was taken on her trial trip. The dimensions of the steamer are:—Length between perpendiculars, 130 ft.; breadth, 22 ft.; and depth, 11 ft. She is fitted with engines having cylinders of 17 and 34 in. by 24-in. stroke, and is built to carry 450 tons, exclusive of bunkers. She was taken over the measured mile four times, and attained a mean speed of 9½ knots, with which the owners (Messrs. Pile, of London) expressed themselves satisfied.

Glenavon.—On February 25th the new steam line fishing boat *Glenavon*, which has been built to the order of Mr. Andrew Robertson, of North Shields, had a very successful trial at sea. She steamed at a mean speed of 10 knots, the engines working smoothly and satisfactorily throughout. The *Glenavon* was built by Mr. James Miller, St. Monans, Scotland, and engined by Messrs. Tweedy, Bros., North Shields. Her dimensions are:—Length, 87 ft.; breadth, 18 ft.; depth, 10 ft. She is fitted with engines having cylinders of 14 and 27 in. by 21-in. stroke.

Burton.—On February 28th the s.s. *Burton*, belonging to Messrs. Henry Samman & Co., of Hull, had a trial. The *Burton* is a first-class cargo steamer of the partial awning deck type, built by Messrs. Edward's Shipbuilding Co., Limited, Howdon-on-Tyne. Her dimensions are:—Length over all, 285 ft.; breadth, extreme, 36 ft. 9 in.; moulded depth, 19 ft. She is fitted with engines by Blair & Co., Limited, of Stockton-on-Tees, with cylinders of 20½ in., 33½ in. and 55 in. diameter, with 36 in. stroke, and two boilers 12 ft. 5 in. by 10 ft. 3 in. A speed of 10½ knots was obtained on the trial. The boilers are fitted with Henderson's patent automatic self-cleaning furnace bars.

Corsican.—On February 28th the *Corsican*, built to the order of Messrs. John M'Farlane & Co., Glasgow, by Messrs. S. M'Knight & Co., Ayr, and engined by Messrs. Muir & Houston, Glasgow, went on her trial on the Clyde. She proceeded to the measured mile at Skelmorlie, and on a mean of six runs obtained a speed of 11½ knots, which was considered satisfactory by all on board. The vessel then proceeded to Southampton, where she is to be handed over to the Royal Mail Steam Packet Co.

New Telegraph Steamer "Norseman."—On March 2nd, the new telegraph steamer *Norseman*, built and engined at Leith by Messrs. Ramage & Ferguson, Limited, for the Western and Brazilian Telegraph Co., Limited, London, left the Firth of Forth to take up her station on the East Coast of South [illegible] *via* London, where a large consignment of cable is to [illegible] on board. This fine steamer, which is probably one [illegible] completely equipped vessels of her class in existence [illegible] een specially designed for laying and picking up [illegible] and within moderate dimensions combines great power with the maximum accommodation for electric appliances, along with most commodious quarters for the staff on board. Her principal dimensions are—Length, B.P., 226 ft.; breadth, moulded, 31 ft.; and depth, moulded, 23½ ft., while the propelling power is supplied by triple-expansion engines, having cylinders 25 in., 40 in. and 62 in. diameter by 39 in. stroke, supplied with steam from steel boilers working up to 165 lbs. per square inch, with which a very high rate of speed is attained. The cable laying machinery, supplied by Messrs. King, Brown & Co., Eninburgh, is on the fore-deck, and abaft are the cable tanks, which are capable of holding many hundred miles of telegraph cable. All the very latest inventions and appliances have been supplied, including electric light, steam steering gear, steam windlass, steam winches, &c., and the cabins with their fittings have all been specially arranged for a South American climate. The *Norseman* takes the place on the coast of the company's other vessel of the same name, and is commanded by Captain Lacy.

Trocas.—On March 2nd the s.s. *Trocas*, which has been built by Mr. James Laing, of Sunderland, for Messrs. M. Samuel & Co., of London, for the Eastern oil and general cargo trade, was taken out for trial. The ship, designed by Messrs. Flannery, Baggallay, & Johnson, of London and Liverpool, is 347 ft. long, by 45 ft. 6 in. beam, by 28 ft. 6 in. deep, and has 13 tanks capable of storing over 5,000 tons of petroleum. Special steaming apparatus and ventilating fan are provided for purifying the tanks when empty, and fitting them for general cargo. The tanks, fore hold and 'tween decks, are all available for a return cargo of general goods. The engines, built by Messrs. George Clark, Limited, are 26 in., 42½ in., 69 in., by 45 in. stroke, and the three boilers are 10 ft. long by 14 ft. 1 in. diameter. On trial, the engines, working at 58 revolutions, drove the ship at the satisfactory speed of over 10 knots, 5,270 tons deadweight being on board at the time. She afterwards left for Batoum to load a cargo for the East, via the Suez Canal.

Clam.—On March 3rd the s.s. *Clam*, built by Messrs. W. Gray & Co., with engines by their Central Marine Engine Works, was taken on her trial. She is the third ship built by this firm for Messrs. M. Samuel & Co., of London, for the carriage of petroleum in bulk through the Suez Canal, and the alternative carriage of general cargo in the oil tanks, the 'tween decks, and the holds. The vessel is built from the designs and specifications of Messrs. Flannery, Baggallay, & Johnson, of London and Liverpool, and is 338 ft. by 43 ft. by 28 ft. moulded depth, being subdivided into 11 tanks with a capacity for about 4,500 tons of petroleum, and is driven by engines of 25½ in., 40½ in., and 67 in. by 45 in. stroke, supplied with steam by three large boilers. On trial, with three of the tanks filled with water ballast, the speed attained was 10½ knots of 65 revolutions, with a heavy head swell on. The trial being so satisfactory, the ship left at once for Batoum to load her first oil cargo for the East.

Hanoi.—On March 9th the s.s. *Hanoi*, built to the order of La Societie Service Subventionne des Correspondances Fluviales au Tonkin, by the Sunderland Shipbuilding Co., Limited, was taken out to sea on her trial trip. The vessel is 240 ft. by 32 ft. by 19 ft. 6 in., classed first-class French Veritas, and English Board of Trade certificates for passengers, spar-deck grade. The vessel will be employed in the mail service between Haiphong and Hong Kong. Accommodation for first-class passengers is placed amidships in teak houses, the dining-saloon is most tastefully worked out in panels of solid oak, special attention has been paid to ventilation to suit the hot climate in which she will trade. The whole of the decks throughout are of teak. Engineers' and officers' berths and mess-rooms are in a large teak deck-house aft, which is also entirely fitted up in hardwood. The main engines are by the North Eastern Marine Engineering Co., Limited, Sunderland, having cylinders 20 in., 34 in., and 56 in. by 36 in. stroke, and during the whole of the trial worked in a most satisfactory manner, a pressure of steam of 160 lbs. was easily maintained, and for six consecutive hours the machinery ran at full speed without a stoppage of any kind or any indication of heating. The mean speed obtained upon this run was 12½ knots per hour, which more than fulfilled the guarantees, and gave entire satisfaction to all on board. A feed-heater and evaporator are fitted by Mr. Jos. Reed, of North Shields, who is both patentee and manufacturer, which worked most satisfactorily. The electric light installation has been supplied by Messrs. C. A. Parsons & Co., of Newcastle. During construction, the vessel

and her machinery have been superintended by Monseuir Kvafft, on behalf of the owners.

Nador.—On March 9th the steel screw steamer *Nador*, was taken for her trial trip off Hartlepool. She is a fine type of modern cargo boat, built by Messrs. William Gray & Co., Limited, and is owned by Captain Burke, of Algiers. Her dimensions are:—Length, 375 ft. over all; breadth, 37 ft.; depth, 31 ft. 3 in. She takes Lloyd's highest class, and is replete with all the latest appliances considered requisite in the construction and equipment of a present-day cargo boat. Her engines are of the well known triple-expansion type, built at the Central Marine Engine Works of Messrs. William Gray & Co., and have cylinders 30 in., 31½ in., and 53 in. diameter, with a piston stroke of 36 in. They are supplied with steam by two large steel boilers, working at a pressure of 160 lbs. per square inch. The vessel was taken out into the bay early in the morning, and manœuvred to the orders of Mr. Berry for adjusting of compasses, and at 10 o'clock a tug conveyed a party on board to witness the trial. The vessel having been put full speed ahead, and the log thrown overboard, a three hours' continuous run was made, the engines making 88 to 89 revolutions per minute, and the log indicating an average speed of 11·66 knots per hour. The trial was of the most satisfactory character in every respect, not the slightest hitch or trouble of any kind arising in the machinery, the bearings keeping cool without the application of water, and the boilers remaining absolutely tight. A full head of steam was kept easily throughout the whole trial, and it was not necessary to ease down the engines at all for anything. The superintendent engineer, Mr. B. Griffiths, of Liverpool, under whose superintendence the machinery has been constructed, was on board, as well as the owner, Captain Burke, and both gentlemen were highly satisfied with the performance of both ship and machinery during the trial. The builders of the engines were represented by Mr. T. Mudd.

Sibun.—On March 11th this ship, built by Messrs. John Blumer & Co., for the Beliye Syndicate of London, under the superintendence of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool, was taken for trial at sea. She is 260 ft. long, 37 ft. beam, and 17 ft. deep, and is of the partial awning deck type, the long bridge being of steel and sheathed with pine. She has turtle-back forward for protection and poop aft. The captain and officers are berthed aft in poop, the engineers are accommodated amidships close to their work, and crew forward in topgallant forecastle. She is fitted with water ballast throughout, except in way of boilers. Her hatches are very large and similar in arrangement to those of other vessels in the same service for shipment of large logs of mahogany. Her machinery is built by Messrs. George Clark, Limited, and has cylinders 22 in., 36 in. and 59 in. diameter, with a stroke of 39 in., taking steam at 160 lbs. pressure from two boilers of 14 ft. diameter by 10 ft. long, built to Board of Trade and Lloyd's requirements. The trial was satisfactory though there was a strong breeze. The engines indicated about 1,050 H.P., and drove the ship at a mean speed of 11 knots as the result of four runs upon the measured mile. No water was run upon any bearings, and the machinery worked throughout without a hitch. Steam was kept with ease, the dampers being on throughout.

Zeno—At an early hour on March 13th, the *Zeno*, a smart-looking steel screw steamer, built by Messrs. C. S. Swan & Hunter, Wallsend, to the order of Messrs. Turner, Brightman & Co., London, left her moorings at the yard and proceeded down stream to test her engines on the trial trip course off Tynemouth. The vessel, which has been built under special survey, and assigned the highest class at Lloyd's, is constructed on the partial awning deck grade, her water ballast arrangement being on the cellular bottom principle. The vessel measures 312 ft. in length, 41 ft. in breadth, with a moulded depth of 23 ft. 2 in. Her engines were built by Messrs. Gourlay Bros. & Co., Dundee, the dimensions of the cylinders being 23 in., 38 in. and 61 in., with a 42 in. stroke. The steamer, which is under the command of Captain Young, made a series of most successful runs over the prescribed distance, proceeding afterwards to Barry Dock to load.

Mark Lane.—On March 14th a trial trip of unusual interest to shipowners at the present time took place in Hartlepool Bay, viz., that of the s.s. *Mark Lane*. This vessel is an old steamer having compound engines whose boilers had become entirely worn out, and it was absolutely necessary that something therefore be done in her machinery department. Her case was laid before the Central Marine Engine Works, who advised as the best course, from an engineering point of view, that the old machinery be entirely taken out and new triple engines of the latest design fitted on board, so as to secure the highest economy prevailing at the present day. This course the owners were unable to adopt owing to the fact that the value of the steamer rendered it in their opinion unwise to expend so large an amount as would thus be involved. A quotation was therefore given for the supply of two new boilers working at 120 lbs. pressure, and for altering the existing engines by fitting new liners in both, which greatly reduced their diameter. This course represented a plan that would be likely to give an economy midway between that of the old engines at low pressure, and that of modern triple engines. The quotation was accepted, and the work of thus altering the machinery to what may be called the high-pressure two-cylinder compound type has now been executed at the Central Engine Works, and has caused a great amount of interest to be excited amongst shipowners in this and other districts as to what will prove to be the result from an economical point of view, seeing now there are so many old steamers that cannot at present be profitably run in competition with more modern vessels. The vessel was taken to sea on the 14th as we have said, and the engines were found capable of being handled in the most satisfactory manner. The newly arranged valve-setting to suit the altered condition of the cylinders was found to have been very accurately devised, resulting in the H.P. being almost exactly balanced on the two cranks, although there existed no independent expansion arrangement on either engine. The engine when fully let out ran freely at 70 revolutions per minute, with the vessel drawing about 14 ft. 6 in. aft, and the speed of the ship was found to be 12¼ knots at these revolutions, a speed that speaks highly for the new propeller that has been fitted of the special type manufactured at the Central Engine Works. The boilers kept up the steam pressure throughout the whole trial with the greatest ease, and altogether the trial seemed to give promise of complete success in every way. The result of the first voyage of the *Mark Lane* after this alteration will be keenly looked forward to, and it is expected the conversion, though not the best possible in the engineering sense, is one that will lead to a large amount of business being done in the same way with other old steamers that are not worth the outlay necessary to fit them with new engines. The trial was witnessed by Captain Couch, the marine superintendent, and Mr. Evans, the assistant engineer superintendent to the owners, Messrs. John Cory & Sons, of Cardiff, and by Mr. T. Mudd, representing the Central Engine Works.

William Storrs.—On Tuesday, March 14th, the above vessel, which has been built to the order of the Red "R" Steamship Co. Limited (for whom Messrs. Stephens & Mawson, of Newcastle-on-Tyne, are the managers), left the yard of the builders, the Tyne Iron Shipbuilding Co., Limited, Willington Quay, for her trial trip. The vessel, which is an admirable type of the modern cargo carrier, is classed 100 A1 at Lloyd's, on the awning decked rule, being fitted with 'tween decks right fore and aft, thus avoiding a break at the after part of the vessel, and the consequent want of continuity in the decks. She is 335 ft. long by 43 ft. broad by 25 ft. 3 in. in depth to main deck, and is designed to carry a deadweight of nearly 5,500 tons. She has been fitted with triple-expansion engines by Messrs. Blair & Co., Limited, of Stockton-on-Tees, having cylinders 24 in., 40 in. and 65 in. by 42 in. stroke, with two very large single-ended boilers, fitted with patent furnaces. After the trial, which was of a highly satisfactory character, the engines working smoothly and a good rate of speed being attained by the vessel, a numerous company sat down to the luncheon, being presided over by Mr. Wm. Storrs, of Stalybridge, the chairman of the Red "R" Steamship Co., Limited, and after whom the vessel was named.

City of Kingston.—On Monday, March 20th, the s.s. *City of Kingston* left the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesborough, for the purpose of testing her speed during a series of runs over the measured mile and also along the coast. Excellent results were obtained under all conditions and the high speed of 13 knots guaranteed by the builders was exceeded by over one knot. Engines were fitted by Messrs. Westgarth, English & Co., Middlesborough, the cylinders being 20 in., 32 in. and 52 in. by 36 in. stroke. The principal dimensions of the steamer are:—Length, 214 ft.; beam,

29 ft. 6 in.; depth, 21 ft. 6 in. She has been built of steel to the order of Messrs. T. S. & G. Vipond, of Montreal, and is of special design throughout for the carrying of fruit and passengers from the West Indian Islands and Florida to Canadian and United States ports. A very handsome saloon for the use of the passengers is fitted in a house erected on the spar deck, the panels and other decorations being a speciality of the builders. Everything which can conduce to the comfort and convenience of passengers in a tropical climate has been provided, including awnings all fore and aft, baths, thorough ventilation of staterooms, saloons, &c. A promenade deck is fitted over the deckhouse and on this is placed the chart and wheel-house. Special provision has been made for the storage of the fruit cargoes and for the ventilation of the holds, &c., by means of special machinery and revolving fans. The same builders have previously built several steamers for this particular trade and in every instance these have proved successful boats; and in the *City of Kingston* is combined the results of this special experience. The steamer has been constructed under the superintendence of Messrs. Irwin & Atkinson, of Liverpool, and at the conclusion of the trials she returned to Middlesborough where she will complete her loading for Jamaica, West Indies.

Azalea.—On March 23rd Messrs. Laird's popular steamer *Azalea*, which has just been overhauled by her builders, Messrs. A. & J. Inglis & Co., went on a trial trip cruise in the Firth of Clyde. The alterations carried out at Pointhouse were of the most extensive kind. The hull was almost completely gutted. New boilers adapted for a pressure of 100 lbs. to the square inch were supplied; the engines were overhauled and fitted with a new H.P. cylinder; the passenger accommodation was renovated, and the deck and deck-houses renewed. The system of ventilating the cattle spaces, which has worked so successfully on the *Shamrock* and *Cedar* was introduced, and everything else possible done to perfect the accommodation for live stock. In every respect the vessel, as she now stands, is thoroughly up to date, and more than ever a credit to her builders. Her speed, which is half a knot more than it was, now approaches 14 knots, and her passenger accommodation is equal to that of the best class cross-channel boats.

Antilia.—The s.s. *Antilia*, recently launched by the Grangemouth Dockyard Co., went down the Firth of Forth on her official trial trip, when a speed of 11½ knots loaded was attained, which was considered highly satisfactory. The steamer is built to the order of the Bahama Steamship Co., of New York and Nassau, and is intended for fruit and general cargo trade between Nassau and New York. Her dimensions are as follows:—200 ft. by 30 ft. by 14 9-12 ft. moulded; net tonnage, 587. The engines, which were supplied by Messrs. Hutson & Son, Kelvinhaugh Engine Works, Glasgow, are 17 in., 27 in., 44 in. by 33 in. stroke. The vessel is fitted with all the latest improvements for working ship and cargo, and is commanded by Captain Montell. A large number of gentlemen accompanied the steamer, and expressed themselves highly pleased with the vessel.

Chieftain.—The steamship *Chieftain*, the latest addition to the Grimsby fleet of steam trawlers built by Messrs. Cook, Welton & Gemmell, and engined by Messrs. C. D. Holmes & Co., Hull, to the order of Mr. T. Robinson, Grimsby, has been taken on her trial trip. Leaving Grimsby she proceeded to the measured mile at Withernsea, where a speed of 9¾ knots was recorded. This vessel has been specially built for what is termed the inshore fishing, where the trips do not exceed six days.

Reviews.

Electric Lighting and Power Distribution. Part I. By W. Perren Maycock, London. Whittaker & Co. 1892.

MR. MAYCOCK is a teacher in the City of Guilds of London Institute, and this book is intended for the use of the beginners in his classes. Chapter I. is devoted to an explanation of standards and definitions. Here he says: "In Great Britain we measure mass (or weight) in lbs. or tons, etc." This surely is a slip of the pen. Mass and weight are not synonymous terms. Weight is correctly spoken of as measurable in pounds, but surely the youngest beginner knows that mass means bulk, and that cubic measure is the proper standard for it, and not avoirdupois. This is an instance of the slipshod use of scientific terms so prevalent nowadays, which we so often deprecate in these columns. Indeed the author has just explained that the terms are not convertible, though he rightly says that two masses of the same substance may be compared through their weight. This fact does not justify him in taking weight as the standard of mass. We have no other fault to find in the book, which is well adapted for the purpose which it seeks to attain. Some excellent rules are given with little tags to help the learner to bring them out of his memory when required. The description of various kinds of apparatus is very completely given, and the methods of distribution are made clear to the comprehension of the dullest. Each chapter has questions on its contents appended, and blank pages for addenda are furnished.

Electric Ship Lighting. By John W. Urquhart. London: Crosby Lockwood & Co. 1892.

OF the numerous works which continue to pour from the press on the subject of electricity we have seen none which appeals more to the interests of our readers than the present volume. It is useful alike to shipowner, shipbuilder, chief engineer, and electrician. Indeed even that omnivorous consumer of books, the general reader, cannot fail to be attracted by it. In a clear and practical manner Mr Urquhart explains the broad principles of the generation and distribution of electricity by comparison with that of other forms of energy, and shows the different plans upon which arc light circuits, and those for incandescent lamps must be arranged. The various types of engine and dynamo made for ships' use are examined, and the advantages and disadvantages of each are discussed. He also lays considerable stress on the position in which the electrical machinery on shipboard is placed. This, he rightly says, has much to do with the success of the installation, and with the life of the plant. The systems of wiring ships has his marked attention. Both single and double wiring have their advantages, but on the whole the author inclines towards the plan of using the hull of the ship as the return lead. What a business the planning and erecting an installation on a big liner is is well shown by his details regarding that on board the s.s. *Majestic*, where there are no less than 1,200 lights, and where a carefully thought-out plan has been adopted to ensure the non-extinction of more than half the lights in the public rooms of the vessel even for an instant, whatever catastrophe may befall the ship. The various methods of jointing cables are illustrated, and so are fittings of every kind in use on board ship, including suitable fixed lamps for cabins, saloons, steerage, engine-room, and cargo spaces, as well as movable lamps for bunkers and suchlike places. Canal and search lights are not forgotten, and the latest types of mast-head and side lamps are referred to. Finally, the chapter on tests will be of especial interest to our readers. The work will be of value to the general reader because it shows him the vast business it is to provide and maintain the lighting of a vessel, to the shipowner because it will help him to make up his mind as to the best plan for lighting his vessel, and will not leave him in blind dependence on his guides, whilst to those who are in charge of the erection and maintenance of plant it will be of constant and everyday use. One idea—and it is not a new one—may be dwelt upon before leaving the subject. It is that in this matter, above all others, good work and good material must be used. If it is not, constant expense and trouble will follow, and even then nothing but dissatisfaction will be the result.

The Principles of Pattern Making. By a Foreman Patternmaker. London, Whittaker & Co. 1892.

THIS is a really interesting book. Perhaps no art is so fascinating to the onlooker as that of pattern-making. The tone of the present book makes us sure that few can endear themselves too much to the man who is engaged in them. Excessive neatness and accuracy are the distinguishing characteristics of the subject, and the writer has imported them into his treatment. There are problems put before the pattern-maker which have to be solved, and which may be solved in many ways. Yet when regard is had to economy, endurance, and above all, to the "legitimate aspirations" of the founder, to whom after all the pattern-maker is subsidiary, there remains only one real solution. And here is where the cunning artificer, who uses his brains as well as his skilful fingers, comes to the front. Pattern-making may be said to be a branch of engineering which does not affect us all. This is, to a limited extent, true. Though the actual manipulation in wood an

iron may not be necessary to every engineer, the fact remains that every fitter, and every engineer ought to know the stages through which the various parts of the intricate machines he has to deal with have undergone. The knowledge is absolutely necessary to the superintendent engineer at all times. It may be vital to the working engineer in emergency at sea. The book is well got up, and furnished with copious illustrations. Whilst the glossary of terms at the end will be found of great value, we could find no term, which really bears on the subject, lacking.

Lockwood's Dictionary of Mechanical Engineering Terms. By the Author of "Pattern Making." Second Edition. London: Crosby Lockwood & Co. 1892.

The author of the little work on pattern-making, which we noticed, has produced a very useful dictionary, for the benefit of those connected with mechanical engineering. The book appeals to a wide circle of readers. Everyone who is connected with the making or using of machinery, or who is occupied in the branch of journalism which deals with these matters, knows the use of a good dictionary of this kind. The number of technical terms in existence is immense. The words used for the same thing differ in one part of the country from that which describe it in another place, whilst on the other hand the same technical word has different local meanings. The words in use in one trade may very pardonably be unknown to the artificers in another, and we know by our own experience that a comparatively short absence from the fitting shop may cause us to hesitate over the meaning of the terms though we do not forget the things themselves and processes referred to. For all these reasons it was apparent that such a book might well satisfy a public want, and the fact that the book has reached a second edition shows that those who used it find it accurate and useful. The present edition contains a couple of hundred extra definitions. These are referred to in the text, but in cases where they are wanted, the inquirer has to turn first to the first reference in the body of the book, and has again to hunt up the second reference in the appendix, before he knows all that about the subject which the "Foreman Pattern-makers" considers it proper for him to know. This slightly increases the mechanical difficulty of using the work, and it would have saved time if the new matter had been embodied in the book instead of being reserved for an appendix. There were, doubtless, good reasons for the course pursued, but we hope that the next edition will correct this fault.

The definitions themselves are clear and accurate, whilst the copious cross references are likely to be useful. On the whole can cordially recommend the book.

The Electrical Trades Directory, 1893. London: The Electric Printing and Publishing Co., Limited. Price 7s. 6d.

This publication, which now makes its annual bow for the eleventh time, is already a very bulky volume. Though it modestly contents itself with the title of a trade directory it is in fact something much more comprehensive. It is not only the Kelly but the Whitaker of the electrical world. There is an amount of useful information to be found within it which is to be found nowhere else. Everything contained in its covers is of practical utility. Take for example the rules for theatre lighting, issued by the London County Council, and the rules of the British, American and French Insurance Offices, as to fire risks in connection with electric installations. A useful list of patents connected with electrical subjects which expire shortly should be noticed, whilst a vast amount of legal information, on the subject of patents in this country and abroad is afforded, as well as the Board of Trade Regulations under the Electric Lighting Acts. Tables relating to telegraphy, and lists of the submarine cables of the world and their various tariffs are not forgotten, and there are full details given of the limited companies concerned with electricity. Almost every business nowadays is involved with some branch of electrical science, and we can confidently say that every one who refers to its pages will be astonished at the quantity of useful and accurate information it affords.

A Manual of Machine Drawing and Design. By D. A. Low & A. W. Bevis. London: Longmans, Green & Co. 1893.

The joint authors of this work are both Whitworth scholars, and are both engaged in technical education. With their knowledge of the subject with which they deal and of the requirements of the engineering student, it would, perhaps, be strange if the result of their labours were not a useful aid to the young engineer. The present volume, however, surpasses expectation. In 370 pages we are given nearly 800 drawings clearly designed, and, in all necessary cases, showing full dimensions of parts. These illustrations show the most modern practice in engineering, and, whilst they are primarily intended to teach the young engineer drawing, a further object is sought: viz., at the same time to familiarise him with the details of machinery most applicable to various requirements, and to instruct him as to the proper proportions for the strains to which various parts of engines are exposed. Finally, the letterpress accompanying the drawings, as well as the cuts themselves, are to provide him ready-made with the notes which are usually the accumulation of years of practical experience, and of interchange of ideas with other intelligent members of his profession. This is, perhaps, a somewhat ambitious programme; but it seems to have been worthily executed. Moreover, in their preface the authors distinctly impress upon their readers that the provision of notes does not exempt the student from making others for himself as he goes along. The necessity for this is obvious. We must keep our knowledge up to date, and there is no royal road to learning. The work of the draughtsman is very exact and very plodding. There is a certain amount of purely mechanical labour in it; and whilst his fingers are busy with his drawing instruments the student's mind may well fix itself upon the reasons which make exceptional points necessary. No trouble seems to have been spared to make the book complete. There are a great many very useful tables included in its pages, and the letterpress makes it not only fulfil its title of "A Manual of Machine Drawing," but would also have justified the authors in assuming a further title and calling it an engineer's vade mecum.

The Standard Electrical Dictionary. By T. O'Conor Sloane. London: Crosby Lockwood & Son. 1893.

Dr. Sloane's works are probably known to our readers, and we need therefore say little as to the author, confining our notice entirely to this the latest book he has produced. The first noticeable point about the volume is its size. It is a very bulky volume to be a dictionary of one of the youngest of the practical sciences. Yet on opening it we see that there are no vain repetitions, that conciseness is throughout recognized as the great desideratum of a dictionary, that terms have had to prove their right to admission before they were accepted, and that, in fine, the rapid development of the science might be a valid excuse with many authors for a volume of even greater size. One way in which the author has kept down the size of his book, without in any way impairing its efficiency, has been by his plan of giving an index at the end of the volume, and synonyms at the end of his explanation of terms. Thus when an elaborate illustration and a history of research in connection with some subject are given these are put under one heading, and all other possible headings under which such a subject might be sought are given as synonyms. Much space is saved hereby, and facility of reference is insured by the fact that all the synonyms will be found in the index, and that will at once show us where the desired explanation is given. We have just referred to the illustrations, and we must add that they are afforded wherever their presence can be useful, and that they are admirably designed for their purpose. They are simple, and do not confuse by the presence of unnecessary details. Finally, we must add that the book is brought thoroughly down to date, and that the printing and paper are excellent. This is therefore a book that cannot fail to be useful to all concerned with electricity. The student will learn much from it, and he who has ceased to be a student will find that doubtful points of knowledge which may have temporarily slipped the memory will be very easily resolved by a reference to its pages.

Second-class Protected Cruiser, Minerva.—The plans of the *Minerva*, second-class protected cruiser, have been received at Chatham Dockyard. Her principal dimensions are:—Length, 350 ft.; breadth, 53 ft.; displacement, 5.500 tons. Her engines are to be of 9,000 H.P., and will be manufactured in the dockyard. Working under forced draught a speed of 20 knots is to be attained, while with natural draught the rate of speed will be about 18 knots. Her armament will consist of five 6 in. guns, six 4·7 in. guns, and nine smaller quick-firing guns.

Correspondence.

It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—Ed. M. E.]

GREAT RANGE OF TEMPERATURE.

To the Editor of The Marine Engineer.

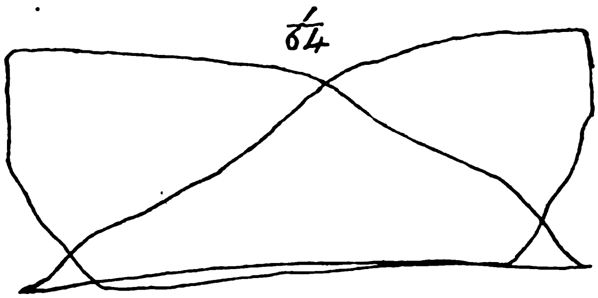
Sir,—The enclosed diagrams are from a ship, built on the north-east coast, and will interest some of your readers. What is the reason of the great range of temperature in the L.P. cylinder?

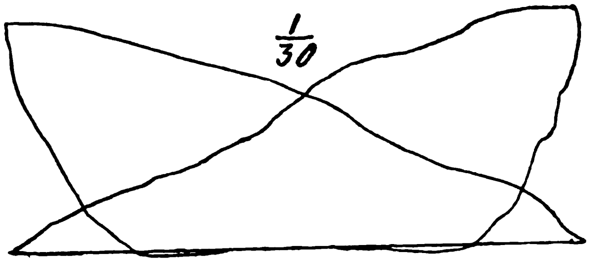
The power developed is smaller than that in the other cylinders, and the range of temperature is much greater.

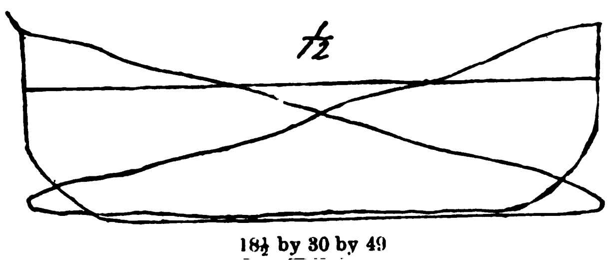
It will be observed that there is very little difference between the gross and the mean range in each cylinder, which is perhaps due to the early cut off, and to the sequence of the cranks, which are set at H.L.I.

David Robson.

Sunderland, March 9th, 1893.







18½ by 30 by 49
———
33

	Mean Pressure.		I.H.P.		Per Cent.		Range of Temperature.
H.P.	64·35	...	184·2	...	33 66	...	66·3°
M.	26 00	...	196·0	...	35 82	...	70·9°
L.P.	8·30	..	167·0	...	30·52	...	74·4°
		...	547·2	...	100 00	...	211·6

Highest temperature H.P.		...	374·6°
Lowest ,, L.P.		...	150·0°
Gross range ...	...	...	224·6°
Pressure.	**Vacm.**		**Revs.**
165	25½		64

VACUUM JACKETS.

To the Editor of The Marine Engineer.

Dear Sir,—I have long had on my mind and notes (and ultimately embodied in one of my specifications) the application of vacua. An absence of "medium" must mean diminished radiation, &c. Professor Dewar's and Mr. Donkin's experiments fully corroborate this. In addition, a top will spin three or four times longer in a vacuum than in air. Then why not "jacket" boilers, uptakes, casings, steam pipes, cylinders, or any part of any engine, motor, dynamo, coal bunker, oil tank, or even bulkheads, or cabin walls, or ship partitions, to which it may be desirable to apply it, by a partial vacuum or absence of air?

The proper application of this principle would render the life of a marine engineer or stoker a comparatively happy one; and would add greatly to the comfort of passengers and crew. It would also avoid a certain amount of danger, surface condensation, atmospheric resistance, dust particles, odour, and a considerable proportion of the noise from vibration, &c., &c.

I shall be glad to hear from anyone who inclines to adopt the suggestion. I have the honour to be

Your obedient and obliged servant,

Robert McGlasson.

39, Dagnall Park, Selhurst, S.E.,
London; March 18th, 1893.

P.S.—Screw propulsion with non-reversible engines. We have now a boat on the Mersey, and another in the Hull Docks, fitted with different adaptations of my screws and gears. I should be glad to hear from anyone who would like to inspect either of them. A third will appear on the Thames in due course.

R. McG.

Miscellaneous.

Bull's Metal.—Some very interesting exhibits were shown by the Phosphor Bronze Co. at the "Yachting Exhibition," held at the Royal Aquarium, Westminster. The following represent a fair sample of the whole of the articles exhibited which were composed of Bull's Metal or illustrative of what could be made of it. A forged propeller blade weighing 5 cwts. for an 8 ft. Thornycroft propeller, this was forged hot from a 14 in. diameter ingot. Tensile strength of test piece was 30 tons per square inch. A forged pump spindle showing part of original ingot. A propeller blade, a test piece from which gave the following results:—Area, ·6082 in.; reduction of area at fracture, 17·3 per cent.; extension on 3 in., 14 per cent.; elastic limit, 13·81 tons per square inch; and maximum breaking stress 25·48 tons per square inch. There was also an illustration shown of a large propeller blade for propeller 17 ft. 6 in. diameter that has been lately cast, and models were shown of the racing sloop *Eva*, built with Bull's Metal frames and (partly) Hull plates; winner of the greatest number of prizes in her class during 1892, owned by Mr. W. L. Wyllie, A.R.A., and of the *Squirrel* racing sloop, 5 tons, built with Bull's Metal frames, and owned by Sir William Pearce. Bull's Metal is a malleable alloy possessing good casting qualities, and can be rolled, forged, stamped, or otherwise wrought at a red heat, and then acquires an elastic limit and tensile strength considerably higher than mild steel. It will be seen from the results of tests given that the alloy possesses a tensile strength and elastic limit almost twice as high as good gun metal, with the same or greater resistance to corrosion, also great resistance to wear.

An Association of Naval Architects has been established in the United States, chiefly owing to the efforts of Lieut. Jacques, late U.S.N., and now Director of Gunnery Construction at the Bethlehem Ironworks. More than 400 members have already joined the association.

Director Reppenhagen.—On March 7th there was launched from the yard of the Vulcan Co. at Stettin, the screw steamer *Director Reppenhagen*, built for the New Steamship Co., Stettin. The vessel, which is 265ft. long, has a carrying capacity of 2,300 tons.

First-class Battleship, Magnificent.—The plans of the first-class battleship *Magnificent*, to be laid down at Chatham Dockyard during the ensuing financial year, have been received by the constructive staff. The vessel will be an improvement upon the *Royal Sovereign* class, and will be 390 ft. in length, with a breadth of 75 ft. She is to be furnished with engines of 13,000 H.P., capable of producing a speed of 18 knots under forced draught, and 16½ knots with natural draught. Her principal armament will consist of four 46-ton guns, mounted *en barbette*. She will also carry ten 6 in. guns, besides a number of smaller quick-firing guns. The sum to be expended upon her during the year is £179,509.

Repulse.—On March 28th the new battleship *Repulse* made her contractors' eight hours' trial under natural draught. The ship was in command of Captain Burnell, of the Portsmouth Steam Reserve. The *Repulse* is one of the eight first-class battleships, of 14,150 tons displacement, which were authorized to be built under the Naval Defence Act, and she is the third of the class which has been sufficiently advanced to undergo her steam trials. The mean results of the eight hours' steaming were as follows:—Steam in boilers, 152·5 lbs.; vacuum, 28½ in. in both condensers; revolutions, 99·4 and 99·3 per minute; I.H.P., 4,967 starboard and 4,566 port, thereby giving a collective I.H.P. of 9,533 horses, or 533 beyond the stipulated power. The mean air pressure in the stokeholds amounted to ·45 in., and the mean speed of the ship, as measured by the Cherub log, was 17·78 knots. The trial was in every respect a success.

How to paint Men-of-War.—In the March number of the *Marine Rundschau* Lieut. Arenhold, of the German Navy, discusses at some length the important question of how to paint men-of-war so as to best secure their invisibility, and comes to the conclusion that, looking to the kind of work to which each class of vessel is likely to be assigned, the most suitable colours are for battleships and large vessels light gray, and for torpedo-boats dull black. The author notes that if to the gray of the big ships a yellow tinge be given, it greatly conduces to invisibility in the North Sea waters of the German coasts. A slight addition of blue to the gray is similarly advantageous in the Baltic. The yellowish gray is, of course, the *toilemouillée* tint which has been adopted by the French.

Earl Spencer on the Navy.—Earl Spencer, replying to the toast of "The Naval and Military Services" at the banquet of the Institution of Naval Architects at the Holborn Restaurant, said that if England had a commerce all over the world the country must have also a Navy, in case of war, to defend that commerce. Within the last 50 years there had been a complete revolution in naval construction and in naval armament, and he was sure the country was grateful for the service rendered in these respects. If we were proud of our *Royal Sovereign* we were also proud of our *Teutonics* and our *Umbrias*. The policy to observe in the Navy in regard to construction was to be sure that this nation maintained its supremacy in the type of vessels, so as to secure the best battleships, the fleetest and best cruisers in the world. His lordship, in conclusion, paid a high compliment to the ability, discipline, and loyalty of the officers and men of the Navy, as well as of the other services, and resumed his seat amid loud cheers.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from February 13th, 1893, to March 18th, 1893.

3131 H. B. Piper. Tubular boilers.
3143 W. Crowther, A. Crowther, and F. Crowther. Steam boiler furnaces.
3145 G. Petrie and J. K. Needham. Steam generator furnaces.
3154 J. Cochrane, jun. Lifeboats and launches.
3189 M. H. Robinson. Steam generators.
3311 G. Clarke. Ash ejectors for steamships.
3343 W. Shore and G. Coupe. Steam boilers.
3367 J. Partington. Man-holes of boilers.
3412 A. Muirhead and H. A. C. Saunders. Submarine cables.
3423 J. Green and E. A. Green. Smoke consumer.
3424 W. Freakley. Steam boiler furnace.
3430 T. Barnfather and C. Kubler. Driving shaft of screw steamer.
3432 A. Stewart, C. Stewart, and J. Farmer. Steam boiler furnaces.
3448 H. Campbell and J. C. Jopling. Steam generators.
3456 C. A. Knight and G. W. Thode. Steam boilers.
3486 E. S. T. Kennedy. Radial tube steam boilers.
3530 G. Gowan. Steam boilers.
3550 B. Shaw. "Capstan" engines.
3563 E. W. Lloyd and C. W. Hutchinson. Discharging torpedoes.
3624 E. R. Billington. Ships' berths.
3629 J. Duckett & Son, Limited. Smoke consuming apparatus.
3706 H. D. Earl. Metallic packing for piston rods, &c.
3711 T. G. Barrow. Apparatus for indicating depth of a ship's immersion.
3712 J. Fairbairn. Steam generators.
3721 T. James. Marine steam engines.
3746 D. Stringer. (W. Stringer, New Zealand.) Recording orders given by ships' officers, &c.
3788 J. Adamson. Thrust block for steamships.
3796 J. Y. Johnson. (T. R. Greenhorn, Ceylon.) Rowlocks for boats.
3806 G. Barker. (S. P. Hutchinson, U.S.A.) Furnaces.
3807 T. H. Ackroyd and Messrs. Willoughby & Co. Smoke-consuming apparatus.
3836 H. Samuel and S. Samuel. Navigable vessels.
3862 A. Stein. Furnaces.
3890 E. Binns. Welded boilers.
3943 G. Knowling. Propelling boats.
3962 D. B. Morison. Marine boiler furnaces.
3977 R. Horsfield. Fire-bars for steam boilers.
3984 S. Fox. Single and double flue steam boilers.
3985 G. W. Hawksley. Steam boilers.
3987 W. Poulton. Boiler seating and flues.
3988 R. Gregory. Steam boiler.
3999 J. Cochrane, jun., and J. P. Cochrane. Fog horns for ships, &c.
4005 E. F. Maxted and W. Wells. Fog signal apparatus.
4026 W. J. Chambers. Preventing fires on coal-laden ships.
4035 A. T. Chamberlain and H. Dickinson. Oars and sculls.
4085 W. Clarke. Governors of steam engines.
4105 R. Dudley. Unloading and loading oil-carrying ships.
4108 B. Liebing. Lubricators.
4172 J. Lister. Steam boilers.
4184 J. E. Cooper. Propelling ships.
4187 D. Young. (The Ranton Boiler Co., U.S.A.) Steam generators.
4239 R. Temperley. Ascertaining the distance of a ship at sea.
4253 G. J. Beedham. Steam boilers.
4271 L. K. Bell. Maintaining the ordered distances between ships in a fleet.
4313 A. Beldam. Steam generator furnaces.
4331 D. France. Smoke-consuming apparatus.
4455 W. D. Grimshaw. Steam-engine valve gear.
4467 J. S. McAndrew. Propulsion of vessels.
4502 F. Tongue. Lubricator.
4521 R. Blezard and J. G. Herod. Speed regulators.
4528 R. Lederer. Steam generators.
4567 H. Vaughan. Propelling boats.
4636 H. T. Grundy and W. Critchley. Steam boiler furnaces.
4650 J. Partington. Vertical steam boilers.
4651 J. Partington. Steam boilers.
4660 F. W. Slaughter. Explosive fog signals for lightships, &c.
4684 D. Purves and J. G. Garrick. Boiler tubes.
4689 W. Cutler. Propelling boats.
4690 R. F. Yorke. Lubricators.
4705 G. F. Alder and E. Rayner. Governor for marine engines.
4719 T. Murphy. Detaching gear for life-boats.
4775 J. G. Cawert. Feed-water heaters.
4795 J. Shaw. Revolving light for ships' sides.
4809 J. Cochrane, jun., and J. P. Cochrane. Sunshades for steam ships.
4832 A. L. Lebeston. Screw propeller shafts.
4834 R. H. Gold. Steam traps.

4846 A. Joyce. Submarine exploration.
4858 J. Knox. Ships' davits.
4895 J. Lumb. Showing water level in steam boilers.
4939 G. Tyzack. Anchors.
4940 G. Tyzack. Anchors.
4969 L. S. Van Duzer. Steering gear for vessels.
5045 J. Meredith. Governor expansion gear.
5061 T. H. Stringer. Funnel with closing appliance.
5071 J. Eynon. Anchors.
5115 J. W. Goodreds. Furnace bars.
5122 R. Scott. Steam boilers.
5149 R. G. Foot. Screw propellers.
5155 E. M. Canneaux. Propellers.
5210 J. McPherson and W. J. H. Adam. Feed-water filter for steam generators.
5211 J. McPherson and W. J. H. Adams. Steam generators.
5248 J. Armstrong. Multitubular boilers.
5263 B. Dunk. Life-buoy.
5297 J. F. Kitching and R. Coulson. Screw steamships.
5310 F. Kovarik. Multiple expansion engines.
5342 W. Cameron. Steam engines.
5352 J. Marshall. Turbine screw propeller.
5359 W. Smith. Preventing timber structures from sea worm.
5363 G. Sinclair. Stoking apparatus for steam boilers.
5379 C. Bonger. Ships' anchor.
5394 T. Greenwood and J. W. Whiteley. Lubricators.
5447 J. R. Haydon. Submarine boat.
5467 J. W. Spencer. Furnaces.
5490 R. Moffitt. Furnace bar.
5496 G. O. Perry and J. R. McGregor. Nautical signals.
5526 J. F. Redman. Tubular boilers.
5530 H. Kaol. Lifting or lowering apparatus.
5545 E. B. Parnell. Heating of furnaces.
5561 S. Dawson. Speed governing apparatus.
5580 E. A. McLachlan. Propulsion of boats.
5600 G. B. Hunter. Shipbuilding berths.
5606 H. Charlton. Anchors.
5627 J. G. Vigo. Ships' water-closets.
5631 F. Dannert. Preventing incrustation on walls of steam boilers.
5634 G. J. Hay. Shoot or feeder for double-decked ships.
5650 J. B. Murray. Screw propellers.
5760 W. F. Hart. (A. McDougall, U.S.A.) Rudders for vessels.
5781 A. J. Boult. (J. T. Ellis, Canada.) Smoke consuming apparatus.
5786 W. G. Wilson. Directors for Whitehead torpedoes.
5819 H. Shield and D. J. Howells. Screw propellers.
5850 J. Cochrane, jun., and J. P. Cochrane. Loading and unloading ships.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1C, denotes First Class; 2C, Second Class.

February 1st, 1893.

Ayre, William 1C N.Shields
Barrow, Wm. 2C ,,
Billowes, A.G.A 1C S'th'pton
Carric, Wm. C. 1C N.Shields
Evans, Ernest 2C Liverpool
Gross, John F. 2C Hull
Harvey, Jn. H. 2C Liverpool
Hetcher, John B. 1C Falmo'th
Hyland, Wm. P. 2C Liverpool
Jackson, James 2C Hull
M'Kenzie, Wm. 2C ,,
M'Auley, Jos. .. 1C Liverpool
M'Culloch, A. 2C N.Shields
Orchardson, J.F. 2C Liverpool
Rigbey, John H. 2C ,,
Robertson, Wm. 2C Hull
Spark, Alfred .. 2C S'n'd'l'nd
Spence, Rbt. S. 2C Aberdeen
Thomson, C. W. 1C ,,
Turpin, Jas. C. 2C Liverpool
Walton, Wm. .. 2C N.Shields
Watson, Jas. A 1C Liverpool

March 4th, 1893.

Andrews, H. A. 2C London
Brand, Andrew 1C N.Shields
Elliott, T. W. .. 2C ,,
Evans, Thomas 2C Liverpool
Fox, Alfred D. 1C London
Gardner, Henry 1C Liverpool
Gowdy, W. H. 2C S'nd'rlnd
Graham, Thos. 2C Belfast
Grindley, H. V. 2C Liverpool
Harrison, Alf. J. 1C Hull
Hatterfield, H.D. 2C Liverpool
Hill, F. John .. 2C N.Shields
Hocken, Hld. W. 1C Hull
Hodgkinson, L. 2C Liverpool
Humphreys, J.A. 2C ,,
Little, Wm. .. 2C N.Shields
Magee, James J. 2C Liverpool
Marr, John .. 2C N.Shields
Mason, M.T. .. 2C ,,
M'Menemy, T... 2C London
Meyer, Alfred .. 2C L verpool
Morton, W. G. 2C Liverpool
Murray, James 1C London
Peet, W. W. .. 2C ,,
Phillipson, C.K. 1C ,,
Phinn, Alex. .. 2C Liverpool
Pritchard, F. W. 2C ,,
Ramsay, David 2C London
Rennie, James C. 2C Liverpool
Renwick, Hy. T. 2C N.Shields
Robinson, J.C.S. 2C ,,
Smith, Colin H. 2C Liverpool
Southwell, W. J. 2C S'nd'rlnd
Stone, John T. 2C Liverpool
Sutherland, J.A. 2C N.Shields
Templer, H. L. 2C London
Tully, W. B. .. 2C Sn'dr'l'nd
Urwin, S... .. 2C N.Shields

March 11th, 1893.

Argent, R. T. .. 2C Cardiff
Atken, F. G. .. 2C N.Shields
Barratt Jas. .. 1C Hull
Beer, Jno. C. .. 1C Cardiff
Bland, Jno..... 2C London
Boskins, Geo. .. 2C Cardiff
Bowen, D. E... 2C ,,
Boyce, Jno..... 2C Glasgow
Campbell, W. A. 2C London
Canty, J. A..... 2C Cardiff
Craig, Jas. A. 2C Glasgow
Craig, John M. 2C ,,
Evans, Wm. C. 1C Cardiff
Fenwick, Thos. 1C N.Shields
Fulton, William 2C Liverpool
Gallagher, Joseph 1C ,,
Gardner, Henry 1C ,,
George, F. G... 2C Cardiff
Graham, Ths. A. 1C N.Shields
Hales, Edwd... 1C Glasgow
Harris, Peter T. 1C ,,
Kelly, Thos. W. 2C Liverpool
Kent, A. J..... 2C Cardiff
Knight, Thomas 2C Liverpool
Kynnan, Richard 2C Hull
Liddall, L. B. .. 2C London
Marshall, H.B. 2C N·Shields
McIvor Wm. T. 1C Liverpool
Moncrieff, Alexr. 2C Glasgow
M'Roberts, Saml. 2C ,,
Munro, J. .... 1C ,,
Pallister Wm... 2C N.Shields
Parsey Benjn. 2C Cardiff
Paterson, Hy. C. 2C Liverpool
Pearse, F. W... 2C Cardiff
Plowright, Jno. 2C Hull
Poocock, H. P. 1C London
Preston, H. W. 2C ,,
Pruckter, Geo.H. 1C Liverpool
Reynolds, Geo. 2C N.Shields
Reynolds, G. H. 2C Liverpool
Robertson Wm. 1C London
Robinson, E. C. 1C Cardiff
Sadd, H. E. .. 2C London
Sewall, J.W. .. 1C Cardiff
Sinclair, C. E. 2C Liverpool
Sinclair Chas. S. 1C Cardiff
Steven, Wm. S. 1C Glasgow
Strang, J. D. N. 1C ,,
Sprott, Robert C. 2C Liverpool
Taylor, John L. 1C Glasgow
Third, Wm. C. 2C ,,
Vassepulos, N. 1C Cardiff
Waites, Wm. A. 2C Hull
Warriner, Hy. J. 1C Liverpool
Wattleworth R. 2C ,,

March 18th, 1893.

Adie, Patrick I. 2C Liverpool
Allen, Andrew.. 2C Dublin
Anderson, D. R. 2C Dundee
Andrewartha, A. 2C London
Ashton, Alfred J. 1C ,,
Baine, C. M. .. 1C Greenock
Baxter, William 1C Leith
Blackmore, W. F. J. 1C Plymouth
Bowen, John D. 2C N.Shields
Brown, James.. 1C Leith
Burns, James .. 1C N.Shields
Campbell, G. M. 1C Liverpool
Clark, William.. 2C Greenock
Doran, Charles 1C Dublin
Fulford, John.. 1C London
Heggie, Thomas 2C Liverpool
Howitt, John .. 2C Greenock
Hunter, John .. 1C ,,
Isles, A. P. .... 1C Leith
James, W. R... 2C N.Shields
Jeffreys, H. W. 2C Leith
Kilgour, Lewis 1C N.Shields
Lake, Charles R. 1C London
Leigh, Thomas 1C Liverpool
Manthorpe, H.W. 1C N.Shields
Martin, D. R... 1C ,,
McLaren R. S... 1C Greenock
McMurray, John 2C Dublin
Paradise, Hy. E. 1C London
Ray, J. W. .... 1C N.Shields
Scott, F. D..... 1C Leith
Service, Alfred.. 1C Greenock
Simpson, Hy. R. 2C N.Shields
Small, Matthew 1C Greenock
Stoker, A. E. .. 2C Leith
Thomson, Alex. 2C Greenock
Trolley, John .. 1C Plymouth
Wallace, James 1C Leith
Walton, C. E... 2C Greenock
Weir, John .... 1C ,,
White, G. J.... 1C N.Shields
Williams, B. L. 2C Liverpool
Williams, T. H. 2C ,,
Wood, John.... 2C London

The Torpedo-boat Forban.—*Le Yacht* announces that MM. Augustin Normand & Co. are about to begin the construction at Havre of a torpedo-boat, to be called the *Forban*, which will attain a speed of 30 knots, or 34½ statute miles an hour. This speed is fully three knots in excess of anything that has yet been attained afloat. The same paper says that the armoured cruiser *Charner*, 4,750 tons, 8,800 H.P., is to be launched on the 18th inst. at Rochefort. From other sources we learn that the somewhat larger armoured cruiser *Pothuan* was laid down early in the year in a private yard at Graville. She is to displace 5,320 tons, and to develop with natural draught 7,500 and with artificial draught 10,000 I.H.P. Her dimensions will be —Length, 370 ft. 6 in.; breadth, 50 ft. 1 in.; and her armament will consist of two 7·6 in., ten 5·4 in., 16 3-pounders, eight 1-pounders, and five torpedo tubes. The torpedo cruiser *Fleurus* is to be launched at Cherbourg on the 18th inst. She will be of 1,310 tons displacement and 4,000 I.H.P., and is to be completed for the pennant during the current year.

The Marine Engineer.

LONDON, MAY 1, 1893.

NAVAL men, and especially those having charge of the machinery of our now magnificent and powerful fleet, have passed the last two years or so under a sense of most unnerving depression and helplessness. The new Navy had developed even in its birth a disease known as the boiler difficulty, and vessel after vessel had returned from her first trials with the same melancholy tale of leaky tubes, creating a feeling that a new and startling phase of trouble had presented itself. Trials and experiments were, however, persisted in, even at great personal risk to the crews, who have shown throughout these troubles that traditional cool pluck and determination which was to be expected of them. A commission was appointed to enquire into the whole matter, and meanwhile the technical staff at the Admiralty were engaged in investigation with a view to a remedy. This has at last been found, and a few days ago Mr. A. J. Durston, the engineer-in-chief, announced that, after a series of exhaustive trials in battleships and cruisers which had failed to develop more than half the regular power, its perfect success had been fully confirmed. The device consists of a cap ferrule of peculiar construction, fitted into the tubes of the boiler, which has the effect of short circuiting, as it were, the intensely hot flame past the hitherto troublesome tube joints, to a part of the tube which is capable of absorbing the heat without injury, at the same time partially protecting the tube plate. It is the invention of Mr. Ed. C. Peck, of the well-known Yarrow boat-building firm at Poplar, and Mr. Durston paid a high tribute of acknowledgment to Mr. Peck in referring to the great importance of its success. The Admiralty are to be congratulated on having solved this very serious matter in such a simple way as to ensure a saving to the country of the removal of most of these boilers at a cost of probably over £200,000. Over thirty of their vessels have been fitted with the ferrules, and Mr. Durston states that they will probably be fitted to the greater part of the Navy. Naval officers and engineers are of course delighted at the turn of events, and the grave anxiety which had up till recently pervaded all ranks when a full power run was ordered, has now given place to the utmost confidence and good spirits, and Admiral Long stated at a recent meeting, "that now that we were again able to *catch* our enemies there would be no doubt about our whipping them." It is to be hoped that the authorities will see their way to recompense Mr. Peck for his useful invention and thereby stimulate private individuals with such capabilities to do all in their power to help such serious flaws as do from time to time appear in the Navy. It is a sad truth that many such gentlemen do hold back, simply from the name which "the powers that be" have got for abstaining from giving any substantial acknowledgments to inventive genius.

SATURDAY, the 22nd April, was a red letter day in the history of the Cunard Line. It saw the departure of that magnificent twin-screw liner *Campania*, about which so much has been said and written, and of which so much is not unreasonably expected. A certain halo of romance still clings to the departure of a liner even now, when canvas is abolished and the punctuality of express trains is observed in the movements of steamships. The interest cannot fail to be deepened in regard to the maiden sailing of this new acquisition to the fleet of the premier company on the Atlantic. When the *City of Paris* and *City of New York* came out it was known that worthy rivals were preparing in the Queen's Island Yard. And when these vessels made their appearance the novelty of 10,000-ton steamers had worn off a little as men had already seen the *City of New York*. But the present pair stand alone and unapproachable. Two thousand five hundred tons greater in register than the *City of Paris*, forty eet longer than the *Majestic*, half as long again as any vessel in her Majesty's Navy, with two sets of engines each more powerful than the full strength, not only of the famous sisters *Umbria* and *Etruria*, but also of the fastest and most recent German vessels, the North German Lloyd, *Havel* and *Spree*, and the Hamburg-American twin-screw quartette, it is no wonder that great expectations are aroused. The contract speed was said to be 22 knots, and the guaranteed H.P. 27,000 effective. At the trial, according to the *Daily News* correspondent, the *Campania* made 23½ knots as a maximum, with 30,000 I.H.P. Experience has proved that these very powerful vessels do better at sea when settled down to their work than they can do on trial, and there seem to be several reasons why this should be so. It is not expedient, it is not always possible, to drive new engines at their maximum power, the men don't yet know the peculiarities of the machines Again, the speed on trial is lessened by the drag of the bottom. On the Atlantic a great vessel is likely to do better than in the shallow water of the measured mile. So it comes that the new boat may be taken to be at least two knots faster than anything else afloat. This should mean a reduction on the Atlantic passage of half a day. The advent of these vessels puts the claim for speed, for the present at least,

beyond dispute. The speed of the *Paris* and the *New York* is so near that of the *Majestic* and *Teutonic* that constant disputes as to speed were arising between the champions of the Stars and Stripes and those of the Union Jack. Even the German *Fürst Bismarck*—to the ready ears of the *Times* at least—felt that occasionally she could make a claim to the front rank. Now it will be all changed. Two knots is an advantage which cannot be argued down. It is in excess of the speed contemplated for the new vessels building at Philadelphia, which, so far, have not professed anything beyond the speed of the *Paris*. But this possible reduction of half a day in the passage—at what cost is it to be obtained? In the mere capital value of the ship an increase of 50 per cent. on the cost of the *Teutonic;* in the working expenses something similar. One hundred and ninety-five men in the engine-room against 168, an increase of 15 per cent. In the coal bill an increase of between 40 and 50 per cent. There is no finality in ship-building. The end of the Atlantic race is not likely to come yet. But the moves are now-a-days, when ships cost £600,000, to be made with a good deal more consideration than when the finest ship of her day stood at £80,000. Meanwhile we wish the new vessels success and prosperity.

It was as long ago as the 2nd of November that H.M.S. *Howe* went on the rocks of Ferrol Harbour. It was only on the last day of March that the prolonged operations came to a successful conclusion, and that the battleship was once more afloat. In reviewing this incident in the history of the Navy several considerations present themselves. Those relating to the stranding itself have already been thoroughly discussed. The first that we must now examine is that of cost. It is certain that the bill will be a heavy one. Thirty-five thousand pounds was the contract with the salvage company. It has taken them five weary and anxious months to earn it, and their profit, if they manage to make one, will not be grudged them. Other expenses have been, and will be, of course, incurred at Ferrol, and when the temporary repairs are finished in the dry dock at the Spanish port to enable her to cross the bay, there will be thorough repairs—in parts we fear practical rebuilding—to be done at Chatham. This, it is said, will cost the country a hundred thousand pounds. Even then it is doubtful if the vessel will ever be her old self. The structure must have been terribly wrenched and strained by the action of the tides first supporting and then leaving alone that heavy fabric twice every day during the long winter months. The catalogue of the injuries, as given by the *Times* correspondent, who has seen her in dry dock, is an appalling one, but we cannot be surprised at it, indeed, we should not have been surprised had it been worse. He says: "The principal injuries consist of a breakage and indentation of some 4 ft. upwards through both bottoms, extending from near the rolling chocks on the starboard side at a breadth of 12 ft. under the after dynamo department, and as far on the port side. The keel is broken and twisted in an ndescribable manner from this breakage aft some 70 ft. On the port side is a hole 27 ft. long by 6 ft. wide. The minor injuries are numerous and important." Yet had she been quite useless she had to be saved, if possible, let the cost be what it might. So well-built a vessel might have hung together for years in the harbour a standing monument to the chartmakers. She has been saved and now must be repaired. The cost may be great, but it is slight in comparison with her first cost, and it is certain that for the cost of the repairs we could build nothing of the value she will be when completed. The other question to regard is the method adopted by the salvors. The slow and patient blasting of the rocks to get at the injuries, and then patching them up as they were reached, is a new feature in salvage. Had the vessel lain in an exposed position she might have gone to pieces long before such a method had a chance of showing its results. But, on the other hand, presupposing the control of dynamite—which experience has shown the salvors thoroughly mastered—this plan had the advantage of making the result assured provided sufficient time were allowed. We should like to have some expert opinions from someone who saw the *Howe* on the rocks, as to whether the old-fashioned methods of lifting by pontoons and chains might not have been practicable. That would have had the advantage of shortening the period of the operation, and thus lessening the injuries received during her stay on the rocks. The salvage company is receiving, and justly, very considerable praise for the successful result of its operations. These it has distinctly earned, but we cannot help feeling that it would have been better if what has been done had been accomplished more rapidly. One aspect of the incident must not be forgotten now the battleship is once more restored to us. We ought never to have been obliged to get foreign aid to float a British man-o'-war. It is said that British salvage concerns were not equal to the undertaking. This we believe to be an error. But in any case the matter ought to be placed in a position where a difference of opinion is impossible. The British Admiralty should either organize a service for its own use or, better still, make arrangements with private bodies, by giving them a retaining fee and encouraging them to keep heavy plant at their service, to do the work for them when

called upon, and to do so at a fair price, based, not on the value of the salvage, but upon the labour and expense involved in the operations.

The time has now come when the Admiralty should justify, in the House of Commons, its recent proceedings in respect of the armed cruiser subventions. It will be remembered how great a thing the late Board of Admiralty was believed to have achieved when it initiated the system, and secured for the country on reasonable terms, not only the rights of hire or purchase of fast mail steamers in case of need, but further made arrangements with the owners of the vessels then existing that they should build vessels far more suitable for war service than anything seen at that time. The results of this agreement were that the vessels to be built for the mail service should, in future, have duplicated machinery, which, with the steering gear, was to be placed below the water line, more extreme sub-division (including longitudial bulkheads between the two engine-rooms) than had hitherto been the practice in the merchant service, and should have their decks strengthened for carrying guns. Moreover, arrangements were made that officers and a certain proportion of men should belong to the Royal Naval Reserve. In the event (we speak now only of Atlantic companies), the White Star Line placed the *Britannic*, *Germanic*, *Adriatic*, and *Celtic*, at the disposal of the Admiralty for hire or purchase, at fixed rates, without receiving any retaining fee, on the understanding (since carried out) that the *Majestic* and *Teutonic* should each receive a retaining fee of 15s. per ton gross register per annum. In like manner, Cunard's were to receive retaining fees for the *Umbria*, *Etruria*, and *Aurania*, and Inman's for the *City of Paris* and *City of New York*, in consideration of which the former were to hold the *Servia* and *Gallia*, and the latter the *City of Berlin*, without fee, at the Department's disposal. So far excellent. The idea was so excellent that our French neighbours adopted it, and applied it to their Atlantic vessels. The Americans approved of the idea, and, of course, improved upon it. They not only adopted the idea, but adopted two of the vessels, the *City of Paris* and *City of New York*, which had been specially built to meet the views of the British Admiralty. That sagacious body might have been told by Macaulay's schoolboy that it was only for their personal convenience that the Inmans remained under our flag. Their treasure was American, and an old authority has told us that where the treasure is there will the heart be also. At the first opportunity the flag was changed. Now the Admiralty saw not only the advantages but also the weak points of the arrangement. What had happened showed very plainly that foreign nations believed in the plan. It also showed the weak spot in the present arrangements. Security might easily have taken from the steamship companies by the Admiralty to prevent the repetition of such a fiasco. This it did not do. It did not give up the whole idea as a bad job, which it might reasonably have done, but it did what weaklings like the Admiralty officials, who control what they do not understand, are apt to do. In its petty anger at losing one company it began to vent its rage on those who had stood true. The *Campania* and *Lucania* are coming out. They are built at great extra cost in accordance with Admiralty requirements, and naturally the fact that they would earn the few thousands subvention which is all the Admiralty gives, was a factor in the owner's calculations. They would make up for the defection of the American liners. But as they come out notice is given that the other Cunarders already earning a subsidy are discarded. If they had not come out their fellows would have been retained. Roughly speaking, the *Umbria* is 8,000 tons gross. The *Campania* is under 13,000 tons. Thus the *Umbria* earned £6,000 a year, the *Campania* will earn £8,600. In order to get the latter sum Cunard's have dropped the former. To get a net increase of £2,600 they have increased the capital cost of the *Campania* and decreased her earning power. Would they have done it if they had dreamt of such treatment? O for the days of Lord Palmerston, when honour and gentlemanly feeling were not put aside in the vestibule of Government offices with ministers' hats and coats!

Marine Engineers are still at work we are glad to see in endeavouring to apply their skill and intelligence to improve the economy and efficiency of the engines they produce. There is no doubt that the best opening for further improvement lies in the reduction of friction. Triple-expansion has probably brought down the amount of steam required per I.H.P. to about the lowest limits that can be effected as far as regards the internal arrangements of the engines, and what is left would appear to be only the improved methods that can be devised to develop the operation of the steam power with the least loss in its development. We do not suppose that we are much beside the mark if we consider that about 15 to 20 per cent. of the whole power indicated in an engine is absorbed in the friction of the moving parts of the engine itself and thus wasted, besides giving rise to heat and trouble at local parts where the friction is most largely developed. The parts which combine by their friction to absorb the said 15 or 20 per cent. of the whole power indicated may be defined as follows:—the friction between the pistons and steam valves on the

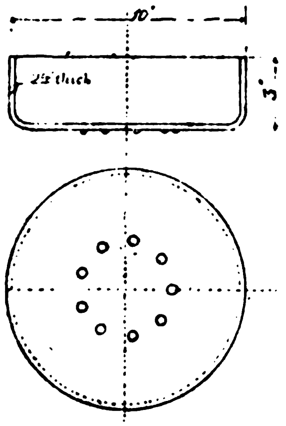
cylinders, the friction of glands on pistons and valve rods, the friction between the cross heads and slide bars, and finally, the friction of the bearings of crank pins, crank shaft, and that of shaft thrust block, which has to bear the whole pressure required to propel the vessel. It is strange to our mind that not more has hitherto been done amongst the engineers to substitute rolling friction, wherever it is possible, for sliding friction. It is well known that ordinary sliding friction, or the friction of journals, can be reduced enormously by the use of rolling friction in place of sliding friction, or by the use of anti-friction ball or roller bearings in ordinary journals, and great strides have been made in this direction in bicycle bearings, where the friction of the journal has so important an effect upon the speed that can be obtained from the machine. What is true in principle for a bicycle must be true also for a marine engine on a much larger scale. We see that the Manchester Association of Engineers have been discussing the best design for main bearings, and there is no doubt that with bearings as they now are, much can be done towards easy running by liberal and efficient lubricators and also by making main bearings in four steps, so as to prevent the gripping of the bearing and consequently unnecessary friction. A large surface which should be in the direction of the length and not by increased diameter will also tend to reduce the chances of running hot and to prevent galling. We have also heard and seen some very interesting experiments upon the substitution of a specially designed anti-friction roller thrust block, which reduces to a minimum the frictional resistance of the shaft due to its end thrust. These are all steps in the right direction, but we think the substitution of rolling friction for all sliding friction in an engine would be the true solution at which engineers should aim. Such devices must, however, be simple in their construction and adjustment, so that for the large scale of a marine engine there is much scope for ingenuity in designs which would fulfil these conditions.

SOME EXPERIMENTS ON THE TRANSMISSION OF HEAT THROUGH TUBE PLATES.*

By A. J. Durston, Esq., Engineer-in-Chief of the Navy (Member of Council).

DURING the past three years various experiments have been made at Devonport with the view of ascertaining the temperature of tube plates and tubes under certain conditions of working, and their bearing on the leakage of tubes, the results of which, it is hoped, may be of interest to the members of this Institution.

Although these experiments are not complete, and will be carried further, it is submitted the record of what has been obtained up to the present will, in addition to being of interest to members, secure their valuable co-operation in making similar experiments, such as those made by the late Dr. Kirk, and published in *Engineering* of July 15, 1892, and thus enlarge the sources of our information, and tend to throw more light on the important subject of the limit of working endurance of tube and plate-heating surfaces, and of the materials of which they are made.



The first experiments were made in 1890, as follows:—

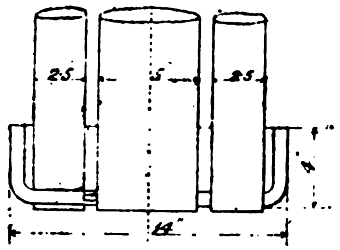
(1) *To ascertain the temperature of the hot side of a plate through which heat is passing to boiling water.*

For this purpose a circular-flanged dish, 10 in. in diameter and 3 in. deep, had attached to the bottom eight pieces of fusible solder of different compositions, the melting-points ranging from 220 deg. F. to 250 deg. F. The vessel was half filled with water, and placed over a Bunsen gas flame—the temperature of which was about 1,500 deg. F.—and allowed to remain until the water had been boiling freely some time. It was then found that the alloys whose fusing-points ran up to 240 deg. F. melted, but the next, which would fuse at 243 deg. F. only slightly softened. The temperature of that side of the plate was therefore assumed to be about 240 deg. F.

A layer of grease obtained from the interior of the boilers of a new ship was next spread about $\frac{1}{32}$nd in. thick over the inside of the bottom of the vessel, and the previous experiment repeated. The temperature of the outer surface of the plate was this time shown by fusible alloys to be about 330 deg. F., or a rise of 90 deg. F., due to the presence of the layer of grease. The increase of temperature was not so large as was expected, and the experiment on being repeated gave virtually the same results.

(2) *To ascertain the temperature at the centre of its thickness of a plate resembling a boiler tube plate exposed to a forced blast fire.*

A flanged $\frac{3}{4}$-in. plate was fitted with short lengths of steel boiler tube, as shown in the sketch, the centre tube being of large size to allow of drilling $\frac{3}{16}$-in. holes in the centre of the thickness of the plate. In these holes were placed square pieces of fusible alloys, and the tubes rolled as usual. Water was then put in nearly to the depth of the flange, and the apparatus



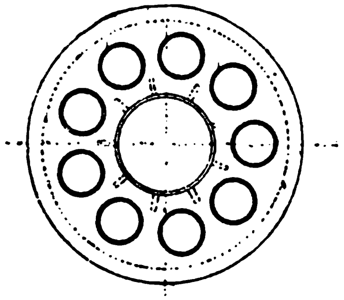
placed over a forge fire, the blast being used, and the temperature of the fire being about 2,000 deg. F. The experiment was continued for about half an hour, fresh water being supplied to replace that boiled away. It was found that the alloys whose fusing points ran up to 290 deg. F. had melted, but the next, which would melt at 336 deg. F. was unchanged. The temperature of the plate at the centre was therefore taken to be between 290 deg. F. and 336 deg. F., a greater temperature even than on

* Read at the Thirty-fourth Session of the Institution of Naval Architects, March 23, 1893.

the fire side of the plate in the previous experiment when using the Bunsen flame (1,500 deg.).

(3) *To determine the temperature of the tube plate at which injurious overheating (i.e., such as to cause leaky tubes) takes place.*

For this purpose a small boiler was made, as shown in Fig. 1, Plate A, in which there were 24 tubes, 2¼ in. diameter. The tube plate being ⅜ in. thick. Of these tubes 8 were brass, 7 steel, and 9 iron, so that any difference in the behaviour of the



different materials might be observed, the tubes being as far as possible grouped in threes (one of each), in order to ensure their being exposed to the same conditions.

A calculated amount of water was put into this boiler, such that, when wholly evaporated, the internal pressure would be 100 lbs. on the square inch, means being fitted to prevent this pressure being exceeded by the expansion of the steam gas. The boiler was placed over a forge with the tubes vertical, and the blast put on and continued until the tube plate showed a red heat, equal to about 1,400 deg. F. The pressure of steam inside was at first 100 lbs., but it fell as the plate overheated. The boiler was then removed from the fire, and allowed to cool.

On testing with water, all the tubes leaked so badly that no pressure could be obtained. No difference was noticed in the behaviour of the brass, steel or iron tubes. This indicated that raising a tube plate to red heat causes tubes of all these materials to leak very badly.

Next a number of holes were drilled and tapped partly through the plate, and plugs of lead inserted. The previous experiment was repeated, the boiler being removed from the fire as soon as the lead melted, it being assumed that the plate was then at about the same temperature as melting lead, viz., 630° F.

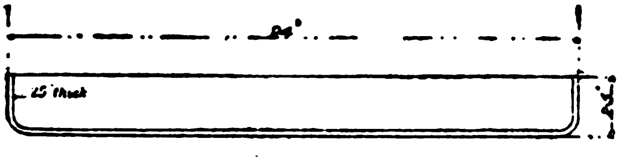
The boiler was afterwards tested by water pressure to 200 lbs. on the square inch, practically without any leaks.

The tapped holes were next filled with zinc plugs, and the experiment repeated, the steam pressure being 80 lbs. on the square inch. Two of the brass tubes split during this experiment, and, on testing the boiler after replacing them by new, it was found necessary to roll two other brass tubes, after which the boiler was practically tight up to the test pressure of 200 lbs., the iron tubes being without a weep, and a few of the brass and steel tubes leaking very slightly.

It is therefore assumed that a tube plate to be overheated sufficiently to make the tube joints leak to an appreciable extent must be raised at least to the temperature of melting zinc, viz., 750 deg. F.

(4) *To ascertain the loss of efficiency of the heating surface of tubes in a boiler, due to a thin coating of grease deposit.*

A tube taken from the boiler of a new ship was cut into lengths and tried in the apparatus shown in Fig. 2, Plate A. This consisted of a rectangular iron vessel A, to hold the water, with holes and stuffing boxes, B, for the piece of boiler tube under test,



the heat being supplied by a horizontal Bunsen burner C. The results of the experiments showed that the thin coating of grease deposited on these tubes during the ship's trials caused a loss of efficiency as heating surface, as compared with a perfectly clean tube, of from 8 to 15 per cent., the mean of many experiments giving 11 per cent.

During the past year (1892) some of these experiments have been repeated on an extended scale, as follows:—

(5) *Temperature of plates when boiling water in an open vessel under various conditions corresponding to previous experiment* (1).

A larger vessel than before, being a flanged dish 2 ft. in diameter, 2½ in. deep, and ¼ in. thick was used, and a constant supply of water maintained. The vessel was placed over a forge fire instead of over a Bunsen burner.

With a moderate blast the temperature of the hot side of the plate was as before found to be 240 deg. F., when boiling fresh water. More blast was then applied, and the temperature of the plate went up to 280 deg. F.

This experiment was extended by repeating it with various foreign substances in the water, with the results shown in the table:—

	Temperature of Hot Side of Plate.	Temperature of Fire.
	F.°	F.°
Clean fresh water	280	2,200
*Mineral oil gradually added up to 5 per cent.	310	2,300
Fresh water, with 2½ per cent. of paraffin	330	2,100
Fresh water, with 2½ per cent. of methylated spirits	300	2,500
†A greasy deposit $\frac{1}{16}$th of an inch thick on the plate	{ above 550 }	2,500

(6) *Temperature of plates when boiling water under various conditions at a higher temperature than* 212 *deg. F.*

The higher temperature was obtained by using a closed vessel, as shown in Fig. 3, Plate A, and boiling the water at pressures above atmospheric. The following results were obtained:—

(*a*) Using clean water and surfaces:

	Temperature of Hot Side of Plate.	Temperature of Water.	Difference.
	F.°	F.°	F.°
Over Bunsen burner ...	430	363	67
Over blast forge (full blast)	430	344·5	85·5

(*b*) Bottom of vessel coated with grease:

	Temperature of Hot Side of Plate.	Temperature of Water.	Difference.
	F.°	F.°	F.°
Over forge fire—Grease deposit $\frac{1}{16}$ in. thick	510	359	151
Do., but using grease of drier or earthier nature	550	351	199
‡Do., and spreading the grease up the sides of vessel as well	617§	80	537

(7) *Experiments showing the behaviour of tubes of various materials.*

The last-mentioned experiments were repeated several times with the apparatus shown in Fig. 1, Plate A, except that the tube plate was ⅝ in. thick, and tubes of copper, brass, iron, and mild steel were tested simultaneously. It is not thought necessary, however, to insert the particulars of these experiments, which varied considerably, as they were repeated on a larger and more reliable scale, as described in Experiments 9 and 10, but it is worthy of remark that on all occasions some brass and copper tubes leaked even when the plate was below the temperature of melting lead, viz., 617 deg. F., showing that these materials did not stand so well as iron or steel, whilst between the latter materials—Staffordshire as well as Lowmoor iron tubes being used—there appeared to be practically no difference.

* Genuine American distilled oil, with the paraffin scale extracted, so that the oil will remain fluid at 32 F., with a minimum density of ·91, and a minimum flash point of 400 F.

† Other experiments showed that this temperature varies greatly, and depends chiefly on the nature and thickness of the deposit.

‡ The grease was spread 1½ in. up the sides of the vessel from the bottom, being then 1 in. below the water level.

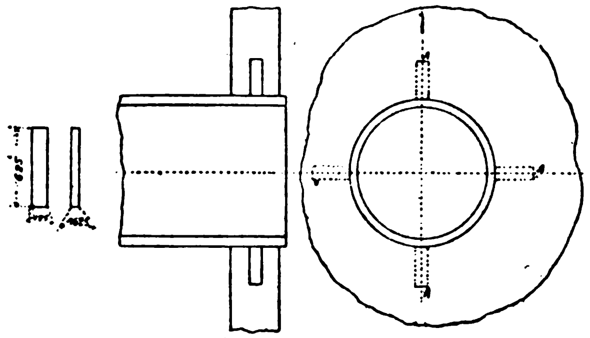
§ This temperature was reached three minutes after placing the vessel on the fire with the blast turned on.

(8) *Experiments to determine whether at higher pressures of steam there is any marked addition to the excess of temperature of the ot side of the plate over that of the boiling water.*

These were carried out with the closed vessel shown in Fig. 3, Plate A. A large number of results were obtained, the details of which showed that there is no marked addition to the excess of temperatures at the higher pressures.

(9) *Experiments on the temperature of the centre of the thickness of a tube plate, with an experimental boiler working with closed ashpits and moderate air pressure.*

Figs. 1 and 2, Plate B, show this experimental boiler with its built-up brick furnace. The tube plates are bolted to the shell, so as to admit of being easily removed and replaced by others.



A Fusible pellets to middle of plate.

As first fitted, the draught was supplied through a closed ashpit, and under these conditions a two hours' trial was made, of which particulars are given in the Table.

Five of the tube holes (see Fig. 3)—Nos. 10, 14, 28, 45, and 59—had each four pieces of fusible alloy ⅝ in. long let into the plate at the middle of its thickness, as shown in sketch. The condition of these at the conclusion of the trial is given on the next page:—The maximum temperature obtained in the combustion chamber was 3,100 deg. F., and the maximum temperature of the steam 366 deg. F.

From the above it will be seen that, of the pieces of fusible alloys placed in the tube plate, all the six whose melting points run from 435 deg. up to 490 deg. F. had fused completely. The ten ranging from 540 deg. upwards remained unchanged. Of the intermediate ones, those having melting points of 500 deg. and 510 deg. remained unchanged, whilst two others with melting points of 520 deg. and 530 deg. were fused just at the ends near the tubes. It would appear therefore that the temperature of the plate at the middle of its thickness did not rise to 540 deg. F., but at some of the tube joints it rose to 530 deg. F.

	Results. Mean.	Results. Maximum.
Steam pressure	143	150
*Air pressure in closed ashpit	·3"	·5"
†Temperature of combustion chamber ...	2,850° F.	3,100° F.
Temperature in tubes (middle of length)	1,550° F.	1,800° F.
Temperature in smoke-box	1,400° F.	1,600° F.
Coal used per hour	188 lbs.	
" " " sq. ft. of grate	30 "	
Water evaporated per hour	1,039 "	
" " " " per sq. ft. of tube and tube plate surface	4·62 "	

* The highest air pressure with the fan then available.
† Temperatures measured by a Le Chatelier Pyrometer.

Number of Tube.	Melting point of Alloy. F.°	Condition after Trial.
59	435	Fused completely.
	450	Do.
	460	Do.
	470	Do.
45	480	Do.
	490	Do.
	500	Not fused.
	540	Do.
10	510	Do.
	520	Fused at end next tube.
	530	Do.
	540	Not fused.
28	550	Do.
	617	Do.
	680	Do.
	773	Do.
14	550	Do.
	617	Do.
	680	Do.
	773	Do.

(10) *Further experiments to ascertain the temperature of fire side and middle of thickness of tube plate in experimental boiler with forced draught and closed stokeholds.*

Due to the difficulty in stoking the boiler arranged as previously described, the flames blowing out into the stokehold unless the draught was shut off the ashpit each time of firing, the boiler was enclosed in an air-tight stokehold, and the draught supplied by a fan and engine of increased dimensions, in order to obtain a higher rate of combustion.

Under these altered conditions the trials were continued, and, in addition to the fusible alloys let into the middle of the plate, four pieces $\frac{5}{32}$ in. in length and $\frac{3}{16}$ in. diameter were fitted into the face of the plate, around each of the tubes mentioned, and as shown in sketch on preceding page. These pellets projected $\frac{1}{32}$ in. beyond the plate.

The following table shows the observations made in five trials with this boiler:

TABLE A.

DATA OF TRIALS

No. of Trial.		1st.	2nd.	3rd.	4th.
Duration of trial	hours	5	5	5	3⅝
Pressure of steam	lbs.	145	142	140	144
Air pressure in stokehold	ins.	3	3 for 1st 2 hours 3½ " next 3 "	3	2·9
Total coal used during trial	lbs.	2,800	3,188	2,632	Not accurately taken.
Total water evaporated	lbs.	14,125	14,775	13,148	10,276
Coal per square foot of grate per hour .	lbs.	90	102	84·2	...
Water evaporated per square foot of tube and tube plate service per hour	lbs.	12·6	13·23	11·76	11·99
Temperature in combustion chamber	F.°	2,750	2,500	3,100	3,200
Temperature of smoke-box	F.°	...	...	1,600	...
Amount of mineral oil used	lbs.	...	...	9	5*
Oil used in percentage of feed		...	...	·07	·05

*Boiler not cleaned out from previous trial·

Plate A.

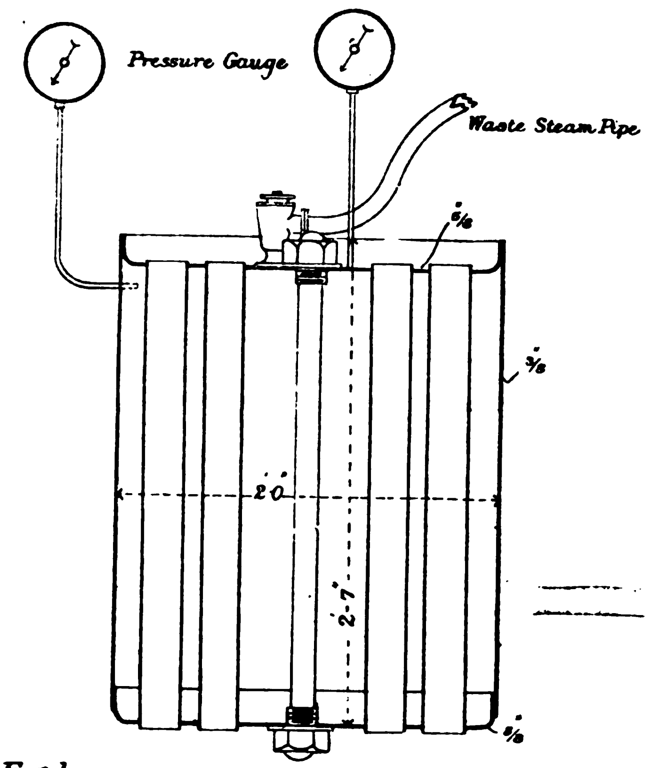


Fig 1.

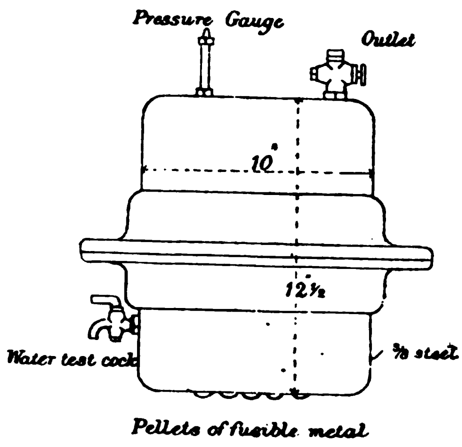


Fig 3

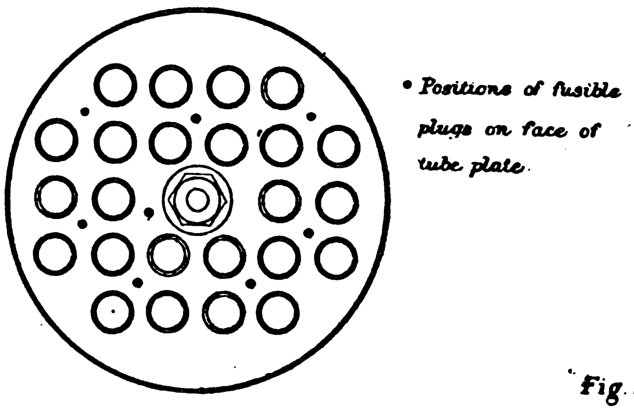
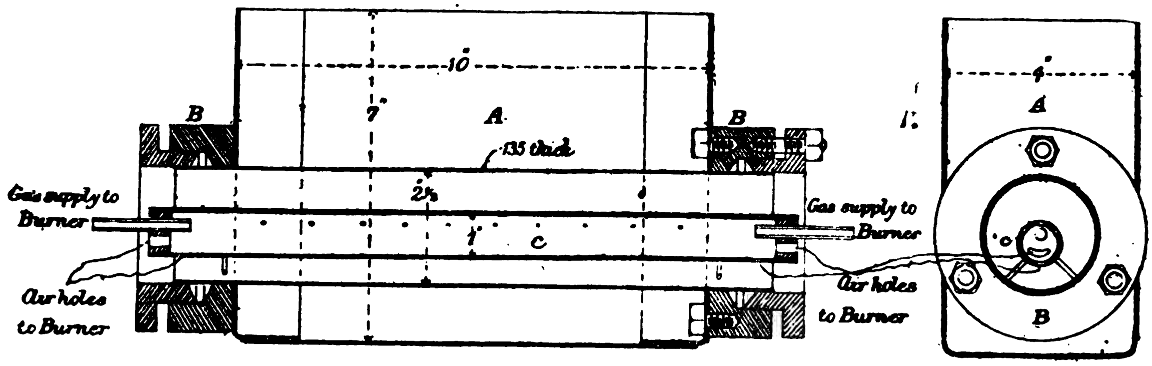


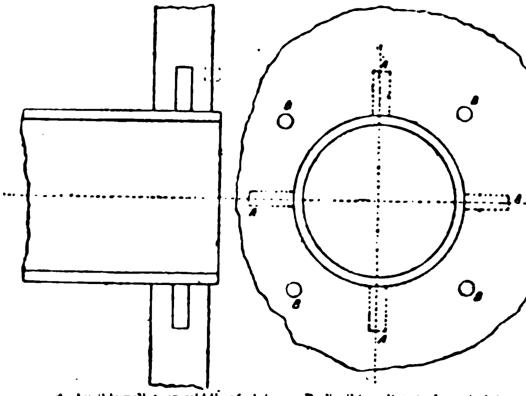
Fig. 2



Apparatus for testing Evaporative Efficiency of tubes coated with grease

On the first trial (five hours with 3 in. air pressure, using clean feed water) sixteen of the pellets in the face of the plate were made with melting points from 490 deg. to 690 deg. F., and the remaining four were of antimony (melting point 1,060 deg. F.). All were melted except the four antimony.

On the second trial (five hours with 3 in. air pressure during the first two hours, and $3\frac{1}{2}$ in. during the next three, using clean feed water) the pellets placed in the face of the plate around each of the five tubes were, as shown in the sketch on the next

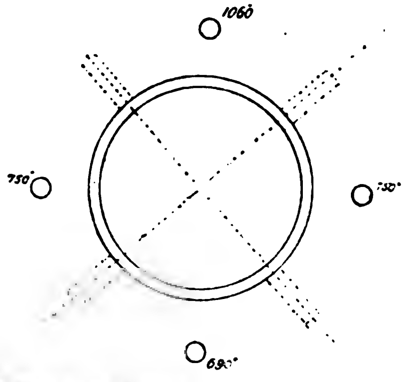


A. Fusible pellets in middle of plate. B. Fusible pellets in face of plate.

page, viz., one of antimony (1,060 deg.), two of zinc (750 deg.), and one of alloy melting at 690 deg. Of these the five antimony and three of zinc (at tubes 14, 45, and 59) remained intact, all the rest melted.

On the third trial, which was of five hours' duration with 3 in. air pressure, with the pellets arranged as on the preceding trial, a total quantity of 9 lbs. of oil was admitted to the boiler mixed with the feed. The five antimony and one (at tube 45) out of the ten zinc plugs remained intact, all the rest melted.

As this was the last trial at which the tubes remained tight, the temperature of the plate should be noted for comparison with the next trial when the tubes gave out.



Since all the zinc pellets melted (except one low down at the edge of the tube plate) the temperature of the tube plate must have been above that of melting zinc (750 deg.) and below that of antimony (1,060 deg.).

On the fourth trial, which was a continuation of the third, an additional 5 lbs. of oil was admitted with the feed water. During this trial the tubes gave out when cleaning fires after $3\frac{5}{8}$ hours run. The pellets in the tube plate were arranged as before, and melted as follows:

Around tubes 10, 14, and 28 (hottest part of the plate) all the zinc and alloys melted; the antimony partly melted in Nos. 14 and 28, but remained intact in No. 10. Around tubes 45 and 49 the antimony remained intact.

This shows that the plate was about the temperature of 1,060 deg. F., at all events during the latter part of this trial, and it is assumed that the tubes then gave out; whereas, from the results of the third trial, the tubes remained quite tight up to and above the temperature of melting zinc 750 deg. F.

The five tubes were now drawn, and the fusible alloys which were let into the plate at the centre of its thickness were examined. They were made with melting points, ranging from 480 deg. to that of zinc 750 deg. F., and arranged as shown in the sketch. All were found to be melted, except the zinc at tubes 14 and 28.

Comparing the highest temperature shown at the face and centre of the plate around the tubes most exposed to heat, the temperatures are as follows:—

Tube Nos. 14 and 28.

Temperature at Face of Plate.	Temperature at Middle of Plate.
Antimony partly melted, *i.e.*, 1,060° F.	680° alloy melted; zinc not melted; *i.e.*, between 680 and 750° F.

(11) *Experiments as to behaviour of Lowmoor iron versus steel tubes as regards leakage in experimental boiler.*

The series of trials above described with the boiler shown in Figs. 1 and 2, Plate B, were utilised for this purpose, the tubes being arranged as shown in Fig. 4, Plate B, so that as far as practicable, Lowmoor iron and steel tubes were placed alternately. Particulars of the four trials made are those given on Table A.

First trial of five hours' duration with 3 in. air pressure. No leakage of tubes occurred at this trial.

Second trial of five hours' duration with 3 in. air pressure for the first two hours, and $3\frac{1}{2}$ in. for next three hours. At the conclusion of this trial the fan was kept going for some time after drawing the fire, but no leakage of tubes occurred. Attention is called to this fact, as great stress is frequently laid on the action of cold currents of air in producing leaky tubes.

Third trial of five hours' duration with 3 in. air pressure, a certain proportion of mineral oil being mixed with the feed water. On this trial no leakage of the tubes occurred.

The fourth was proposed to be an eight hours' continuation of the last, using oil in the proportion shown on the table. At this trial leakage of tubes occurred under the following circumstances:

Just before the end of the fourth hour the fire was being burned down to clean it, in order to be able to work for eight hours, the air pressure being gradually reduced. Ten minutes after beginning to burn down, and with the air pressure at 1 in., the tubes gave out, and began to leak badly. On examination of the boiler, it was seen that six Lowmoor iron tubes and one steel tube leaked badly; three Lowmoor tubes and nine steel tubes leaked slightly. On applying water pressure it was found that at 60 lbs. all the tubes in the boiler leaked, more or less, except No. 34 and the tubes in the two bottom rows, which were probably protected by ashes, &c., during the trial; but the three Lowmoor tubes, Nos. 14, 16, and 18 were leaking most.

The results of these trials, therefore, appear to show that Lowmoor iron tubes are at least not superior to steel ones; and, as from experience we know the latter will stand more rolling than the ordinary iron tube of commerce, it justifies our preference for steel tubes.

(12) *Results obtained with grease in boilers.*

As bearing on the important point of the presence of grease in boilers, it may here be stated that in one of the Yard boilers at Portsmouth the furnace crown came down shortly after concluding some experiments in using greasy water. In a similar boiler at Devonport the Adamson joint of the furnace gave out after similar treatment. These boilers were ordinarily worked at about 60 lbs. pressure and used only fresh water from the Yard mains, and had experienced no serious defect till the introduction of grease experimentally. This is again borne out by repeated examples in Navy boilers of all types of the deleterious effect of the presence of grease in them. Referring back to the former part of this paper, the five experiments on page 4 and the three experiments on page 5 also show how very great is the effect of grease on the water side of the plate-heating-surface. These are also confirmed by the trials with the experimental boiler, which, although subjected to the high temperature of about 3,000 deg. F. in the combustion chamber, and 1,600 deg. in the smoke box, and further subjected to hard treatment by admission of cold air through the tubes after drawing the fire at the conclusion of the second trial, did not leak till grease was used in it.

(13) *Experiments on the temperature at various parts of the tubes of an ordinary marine boiler.*

The following experiments were made to ascertain the fall of temperature of the products of combustion in passing through the tubes of an ordinary marine boiler used in Keyham Yard.

PLATE B

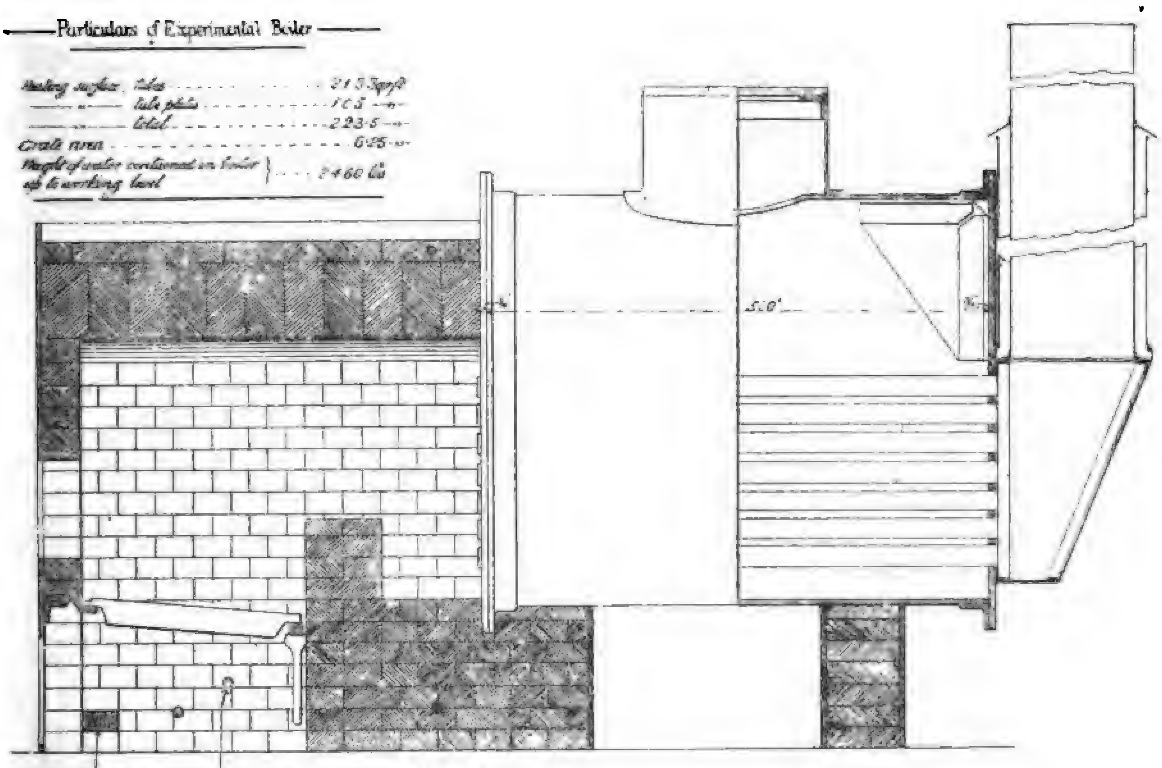


Fig 1

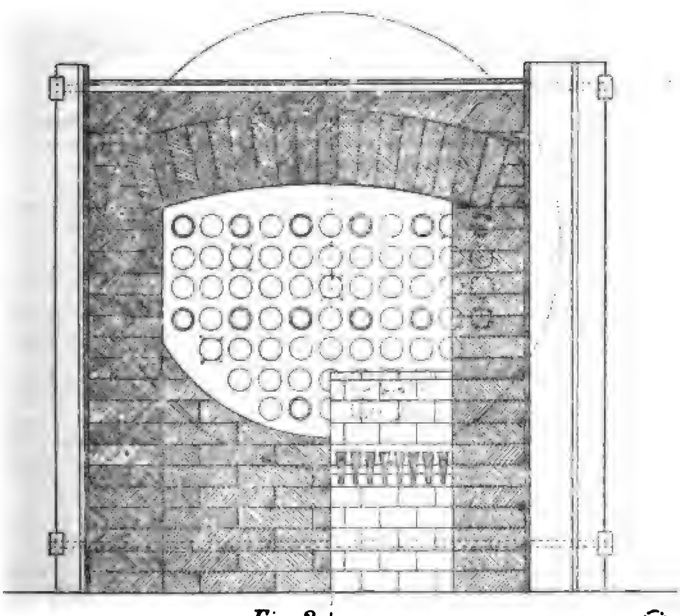


Fig. 2

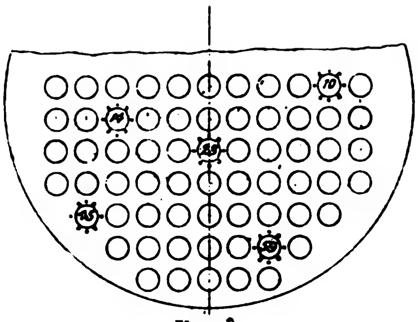


Fig. 3

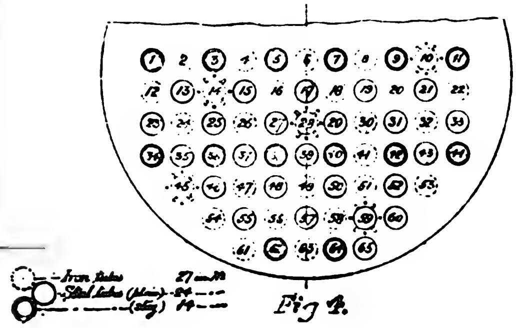


Fig 4.

This boiler (see Figs. 1 and 2, Plate C) had two furnaces and 166 return tubes 2¼ in. external diameter, and 6 ft. 8 in. long from outside to outside of tube plates.

The temperatures were taken by a Le Chatelier thermo-electric pyrometer, the junction of which was passed through the smoke box and down the centre of the tubes, as shown in the sectional elevation. Tubes in a vertical row nearly over the centre of one of the furnaces were taken for the experiment. The temperature was recorded at each foot length until near the combustion chamber, where it was taken at every inch. The boiler was being worked at its normal capacity, the consumption of coal being about 17 lb. per square foot of grate.

The following are the mean results of eight sets of records:—

made by shortening these tubes by 1 ft. and lengthening the combustion chambers by the same amount, and making comparative trials as compared with the boiler as now arranged.

The above concludes, so far as we have gone, what may be termed the experiments made on a small scale, and an account will now be given of some experiments on a larger scale on ship board, with the object of avoiding leakage of boiler tubes. It is a matter of common knowledge that the Admiralty has experienced considerable trouble with leakages of tubes in the double-ended common combustion chamber boilers and those of the locomotive type.

Of the former there are three kinds, distinguished by having either two, three, or four furnaces at each end.

PLATE C

Boiler in which Experiments were made to ascertain the fall of temperature of gases in the tubes

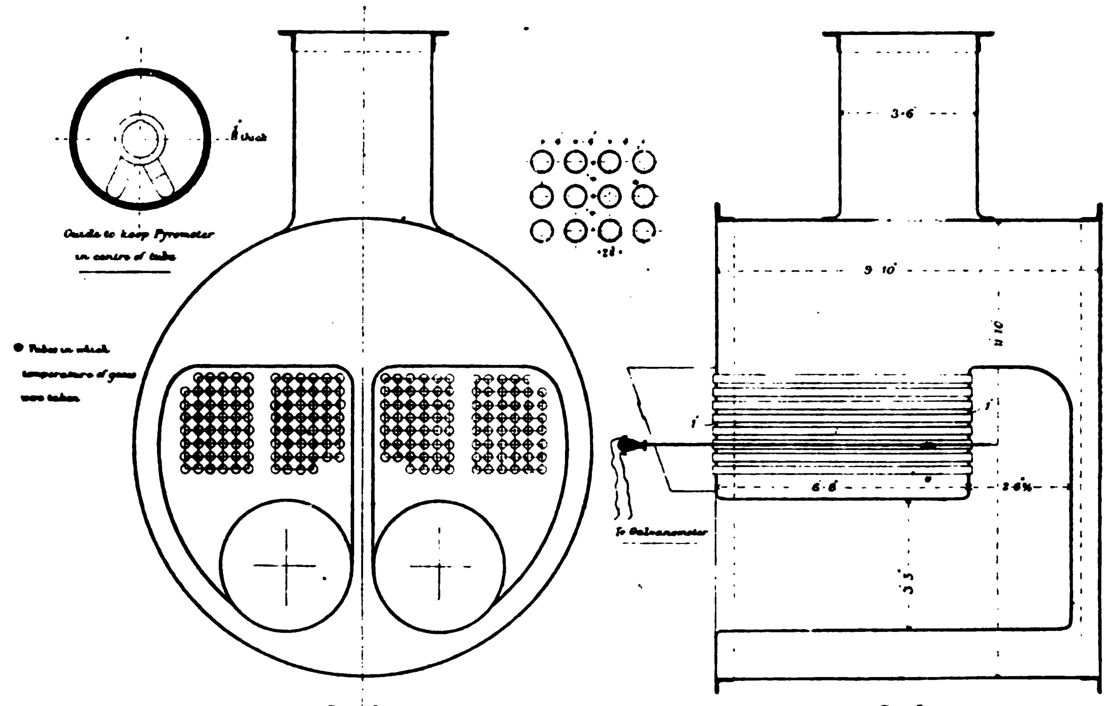


Fig 1 Fig 2

				Deg. F.
Temperature in Combustion Chamber				1,644
„ just inside tube				1,550
„ in tube 1 in. from Combustion Chamber				1,466
„	„	2 in.	„ „	1,426
„	„	3 in.	„ „	1,405
„	„	4 in.	„ „	1,412
„	„	5 in.	„ „	1,398
„	„	6 in.	„ „	1,406
„	„	7 in.	„ „	1,400
„	„	8 in.	„ „	1,410
„	„	1 ft. 2 in.	„ „	1,368
„	„	1 ft. 8 in.	„ „	1,285
„	„	2 ft. 8 in.	„ „	1,198
„	„	3 ft. 8 in.	„ „	1,106
„	„	4 ft. 8 in.	„ „	1,015
„	„	5 ft. 8 in.	„ „	926
„	„	6 ft. 8 in.	„ „	887
„ in Smoke box				782

These results are plotted out and shown graphically on Plate D.

It will be seen that about $\frac{2}{11}$ths of the total fall of temperature takes place in the first 2 in., after which the fall is fairly evenly distributed throughout the length of the tube.

The above shows that even beyond 6 ft. in length there is an appreciable transfer of heat, but a further experiment will be

As regards the two-furnace type, various expedients have been tried in one or other of the ships so fitted to overcome the leakage. These may be summarised as follow:—

Rolling tubes with a shoulder inside the tube plate.

Beading tubes over the tube plate.

Rolling the tubes parallel.

Fitting ordinary ferrules in tubes.

Shortening the grates, involving an increase in the air pressure.

Replacing the stays from the top of the combustion chamber to the shell of the boiler, by dog stays having no connection with the top of the boiler.

No definitely beneficial results have attended any of these measures.

The modification in these boilers that gave the greatest benefit was that of removing two vertical rows of tubes over the centre of each furnace, as suggested to me by Mr. Seaton, of Messrs. Earle's, and this has been applied to all the boilers of that type.

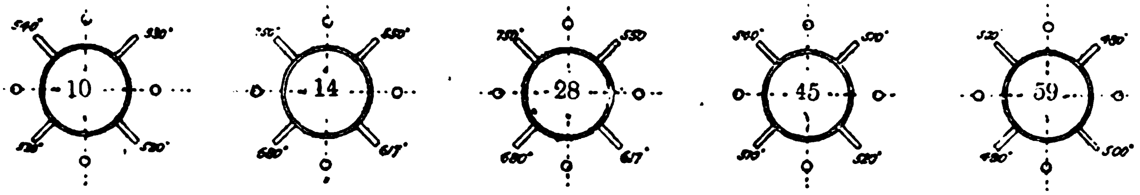
It has also been applied to those having three and four furnaces at each end, but the results in these cases were not nearly so satisfactory. In these boilers the expedients of shortening the grates, and easing the stays immediately above and below the tubes, so as to allow a slight movement of the tube plates with the expansion of the tubes, have also been tried, but with no permanent benefit.

Continued experience with the *Thunderer* and *Vulcan*—vessels having this double-ended common combustion chamber boiler

with three furnaces at each end—was so unsatisfactory, both on trials and on actual service afloat in the former ship, that the reboilering of these ships, as well as the *Devastation*, was provided for in the Navy estimates for the current financial year.

In all these boilers the combustion chamber was divided by brick walls into a separate combustion chamber to each furnace, or to each two adjacent furnaces in the eight furnace boilers. In the *Thunderer* and *Devastation*, from the arrangement of the nests of tubes, it was only possible to divide the combustion chamber into two parts, one to each end of the boiler.

Concurrently with the efforts that were being made to overcome the leaky tube troubles by improving the circulation, experimental trials were being conducted in the locomotive boilers of the torpedo gunboat class: (1) by plastering the tube plate with a non-conducting composition, thus protecting it on the fire side, and (2) by ferruling the tubes with fireclay cap ferrules, the caps of which afforded protection to the tube ends and the larger part of the tube plate.



The object of these experiments was not to demonstrate the effectiveness of the materials used, but to show whether the leakages of boiler tubes were not due to the overheating of the tube plate and ends. This was established, for as long as, in the first case, the cement adhered, and in the second case the ferrules lasted, leakages did not occur. They were, however, both liable to rapid destruction, and could not be relied on as a permanent protection.

Numerous devices having a similar object were from time to time suggested, but all had practical difficulties preventing their adoption.

Amongst the first of the practical suggestions made for ferruling the tube ends was that patented by Messrs. Humphrys, Tennant & Co., and illustrated by Fig. 1, Plate E. It will be seen that this ferrule is screwed into the tube at the fire-box end, and that the cap fits into an annular recess cut in the tube plate. The principle of this ferrule is that when a contraction in diameter takes place, due to variations of temperature, the outer part of the ferrule tends to tighten upon the concentric portion of the tube plate. Further, as the ferrule is screwed into the tube, it has the advantage of the holding power afforded by the rolling of the tube into the cooler smoke-box tube plate. It will also be seen that from its construction it provides a large amount of jointing surface, and an intricate passage to prevent the escape of water. On the other hand, it has the disadvantage that tubes cannot be withdrawn for cleaning and repairs, but must be cut out, and it is somewhat costly in fitting.

Messrs. Humphrys' proposal to fit these ferrules in the two after six furnace common combustion chamber boilers of the *Medea* for trial was approved.

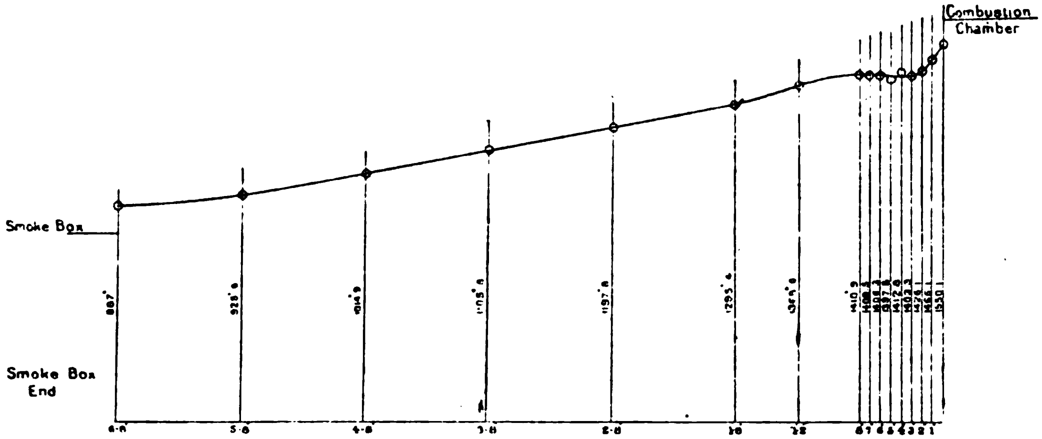
For these trials iron tubes were fitted in the starboard boiler, and steel tubes to the port boiler.

The modifications that had already been made in the furnaces, combustion chambers, and tubes were allowed to stand for these trials. They consisted in shortening the grates of the middle furnaces by the removal of the back tier of bars, dividing the common combustion chamber by brick walls to form a separate combustion chamber to each furnace, and the removal of vertical rows of tubes over the furnaces.

An eight hours' trial of both boilers was made at natural draught power, which was satisfactorily obtained with a mean air pressure of 1·26 in. The examination of the boilers showed that about seventy tubes in all had leaked very slightly. The ferrules had practically not scaled by oxidation. The leaks were so trivial that nothing was done to them before proceeding with the four hours' forced draught trials, which were successfully made with each boiler singly, 1,895 and 2,039 I.H.P. being obtained with the starboard and port boilers respectively with 2·85 and 2·9 in. of air pressure, as against 2,250 I.H.P., the specified power per boiler. On examination slight unimportant leakage of the tubes was observed, and the ferrules were practically free from oxide scale.

Subsequently the eight hours' natural draught trial was repeated, 3,013 I.H.P. being obtained with a mean air pressure of 1·05 in. On examination, a few tubes were found to be leaking slightly under the water pressure, but not sufficiently to necessitate further rolling. No difference was observed in the behaviour of the iron and steel tubes.

Shortly after the above ferrule was suggested, Mr. Peck, of Messrs. Yarrow's firm, sent me a letter proposing a ferrule of the shape shown in Fig. 2, Plate E. The points claimed for this in his own words were as follow:—



Curve showing Fall of Temperature of Gases going through the Tubes of a Boiler at work.
Scale of Abscissæ 1 in. 1 ft. Ordinates 1 in. 500°.

"Something in this direction has, I am aware, been already proposed, but in this proposal you will see that the tube ferrule or protector does not touch the tube where it is fixed to the tube plate, but is in contact with the tube only at a part where all its heat may be readily absorbed. The space between the protector and the tube is rather exaggerated in the sketch, but is only intended to be that due to expanding the ordinary straight tube."

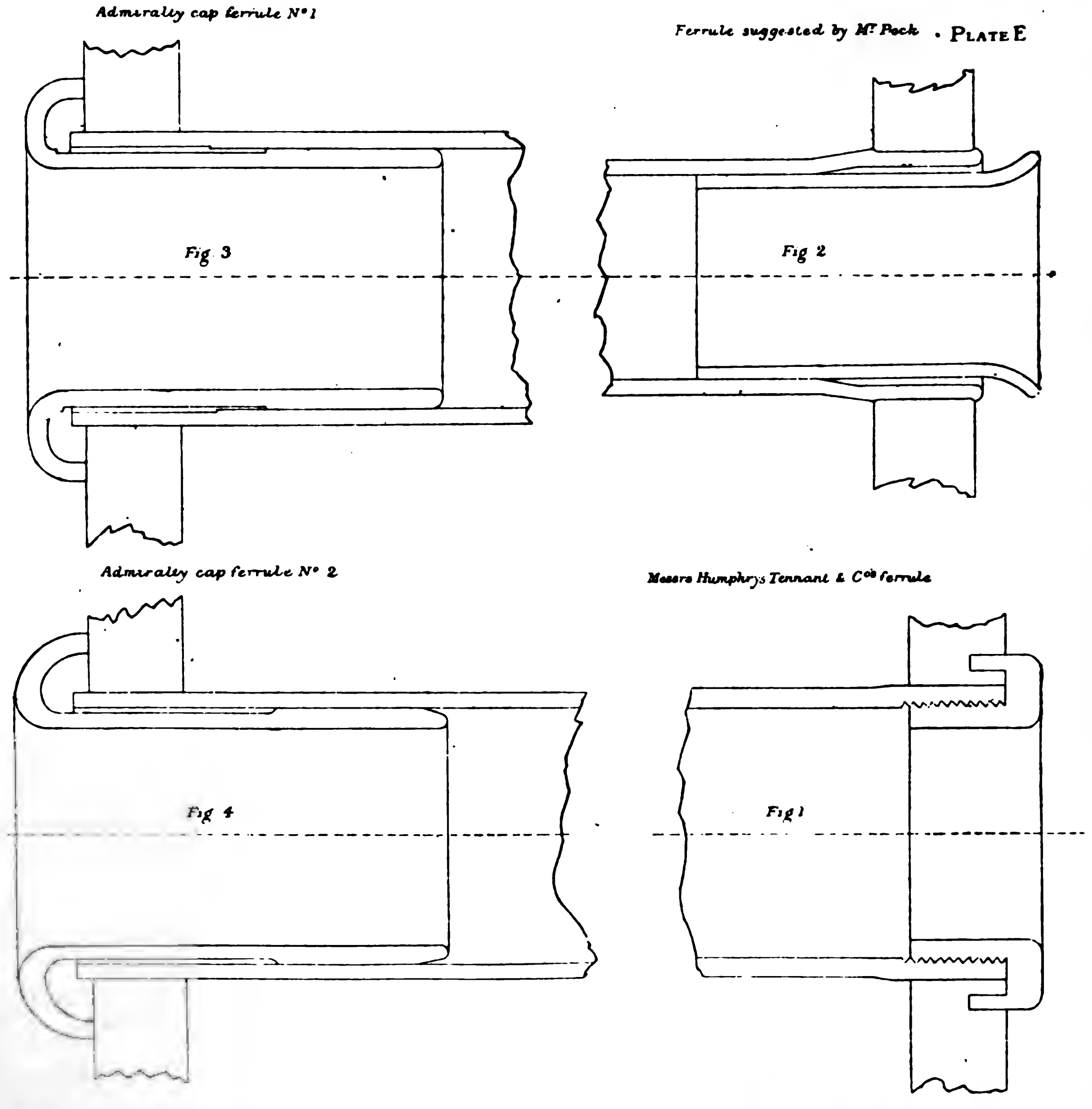
It will be seen from this that Mr. Peck considered the space produced by the rolling of the tube in the tube plate would be effective in producing the desired result; and it was not proposed to protect the tube plate by any flanging of the ferrule.

The idea of a space formed between the ferrule and the tube at its junction with the fire-box tube plate was recognised as an important point, and a few hours subsequently Mr. Oram, Engineer Inspector, proposed to me the cap ferrule shown in

Fig. 3, Plate E, as one which would provide an effective air space between the ferrule and the tube at, and for a short distance beyond, its junction with the tube plate, and by its cap also protect the greater portion of the fire-box tube plate from direct contact with the products of combustion, and proportionately reduce the formation of steam on the water side of the tube plate.

Experience has resulted in the shape of ferrule shown in Fig. 4, Plate E, but it will be seen that the effective points remain the same.

In order to make a practical test, these cap ferrules were



fitted in the *Barracouta's* boilers, which were of the double-ended common combustion chamber type. The port boiler was fitted with wrought steel ferrules, and the starboard boiler partly with the same and partly with malleable cast-iron ones.

On an eight hours' trial of the port boiler at natural draught, 978 I.H.P. was developed, with a mean air pressure of 1·07 in., as against 950 I.H.P. specified, the trial being in all respects satisfac- [illegible] was found that not a single tube had leaked; some of the [illegible]re loose, and could be turned round by hand, but none [illegible]uld be swept out by a brush. The faces of the ferrules, [illegible] few cases the insides, showed signs of burning and

The loose ferrules were tightened by light rolling with expanders, and on a four hours' trial of the same boiler at forced draught, 1,450 I.H.P. was developed with a mean air pressure of 2·41 in. Slight priming occurred, which prevented the development of the full power of 1,500 I.H.P. This trial was also satisfactory, examination showing that no tubes had leaked. The scaling of the ferrules seemed to be no worse, the first formation appearing in a measure to protect the ferrules from further burning.

Next an eight hours' natural draught trial was made of both boilers; 1,912 I.H.P. was satisfactorily obtained with a mean air pressure of ·69 in., the specified power being 1,900 I.H.P. All the tubes in the port boiler were tight, but one tube in the starboard boiler showed slight indications of having leaked.

The scaling of the ferrules—more especially the wrought steel ones in the port boilers—after this trial was observed to have increased; the first formations had in many cases curled up and broken off, leaving fresh surfaces exposed to the fire, and consequently new scalings had formed. A few ferrules were loose.

A forced draught trial was next made with the starboard boiler. Difficulties arose with the fans, and it was decided to stop the trial after three hours; 1,416 I.H.P. was obtained with a mean air pressure of 2·3 in. Not a single tube leaked.

Subsequently an eight hours' natural draught trial with both boilers was repeated, 1,932 I.H.P. being developed with a mean air pressure of ·77 in. Examination of the boilers showed that not any tubes had leaked, a few ferrules were loose, and further breaking off of the scale and deeper burning of the ferrules had occurred. It was noticed that the scaling of the malleable cast iron ferrules appeared to be much less than that of the wrought steel.

At the conclusion of these trials the full water pressure test of 245 lbs. was applied to both boilers, and not a single tube leaked.

After these satisfactory trials the ferrules were fitted to the six furnace double-ended common combustion chamber boilers of H.M.S. *Thunderer*, which had given great trouble from leaky tubes at all powers down to less than one-third natural draught.

On an eight hours' natural draught trial after the cap ferrules were fitted, the I.H.P. obtained was 5,900, with an average air pressure of 1·2 in., the specified power being 5,500. Examination showed a few throat seams, rivets, and stay nuts to be leaking, but not one tube.

Next, a four hours' forced draught trial was carried out, the results being 7,066 I.H.P., with an air pressure of 1·96 in., that specified being 7,000. Examination showed only ten tubes leaking slightly out of about 3,000.

With a view to testing the durability of the cap ferrules, the *Thunderer* was directed to proceed to Madeira and back at four-fifths of her specified natural draught power, *i.e.*, 4,400 I.H.P., and sailed for that purpose on the morning of July 16, at 6 a.m., arriving at Funchal at 1.30 p.m. on the 20th. Leaving again at 9.30 a.m. on the 23rd, the power on entering the Bay was increased to 4,700 I.H.P., and maintained till Portsmouth was reached at 3.45 p.m. on the 27th. The average speed out and home was 12·8 knots. Examination of the boilers showed one ferrule to be missing, and its corresponding tube leaking, also one adjacent tube showed signs of having leaked slightly. Several ferrules had become loose, but could not be removed by hand. The ferrules were thickly furred in the manner frequently observed in torpedo-boat locomotive boilers, and about 30 out of 3,000 were worn out.

During the past week, the *Vulcan*, after having the vertical rows of tubes—those which had been removed to improve the circulation—replaced, and the tubes cap ferruled, has gone through a satisfactory four-hours' forced draught trial, the I.H.P. being 12,032, as compared with 12,000 I.H.P. specified, the mean air pressure being 1·8 ins.

These cap ferrules have been fitted to several other ships having various types of boilers with satisfactory results, and requests for them are being made by ships of the Fleet with the view of protecting the tube plates and ends from overheating produced by accumulation of grease or scale in the boilers, and they will be probably fitted to most vessels.

In respect of protecting the tube plates and ends from overheating, whether by want of circulation, excessive temperature in the combustion chamber, or from the presence of grease or solid matter, it is submitted these cap ferrules have fully answered their intended purpose.

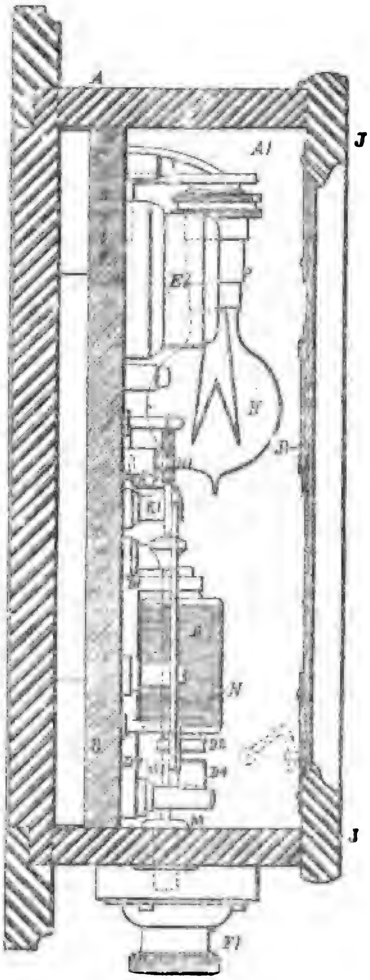
In conclusion, I beg to take this opportunity of expressing the very deep obligation I feel under to my brother engineers of the Admiralty, Dockyard, and Fleet for their cordial co-operation and assistance in the endeavours that have been made to elucidate and overcome the difficulties that have arisen in modern practice with marine boilers, and for the cool pluck and determination with which they have carried out their arduous duties on the steam trials in connection therewith. Last, but not least, a meed of praise is also, I consider, due to the artificers and stokers of the Fleet for their important share in this work.

A Ferrol correspondent telegraphs that the employment of steel plates has been definitely decided upon in the provisional repairs of the damages to the hull of the *Howe*. The operations, which are expected to occupy three months, were begun yesterday. Mr. James Dunn, Chief Constructor, arrived at Ferrol from London on Monday.

The Hamburg-American Steamship Co. purposes acquiring a loan of 7,000,000 marks with the object of purchasing further cargo-steamers with 'tween deck passenger accommodation.

ELECTRIC MAST-HEAD AND SIDE-LIGHT INDICATOR.

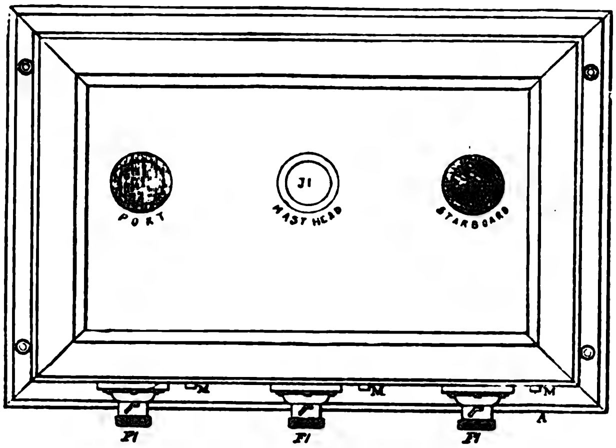
THE patent which forms the subject of this article has for its object to make provision in an improved manner against delay, inconvenience, and danger, when electric lights are employed for ship's mast-head and side-lights, in the event of any of the lights becoming extinguished. The apparatus, which is the combined invention of Mr. W. C. Martin and Mr. John Hunter, 137, West Regent Street, Glasgow,



consists essentially of a box with three windows marked mast-head, port, and starboard. Inside this box are three small incandescent lamps, and these are connected with the circuit supplying current to their respective lamps, that upon any of the lamps being extinguished in any way a bell attached to the box, which is situated either in the wheel-house or other suitable place, rings, and the lamp in the box, corresponding to the defaulting lamp is immediately illuminated, thereby giving due warning to the officer on watch at the time. In addition to this action an auxiliary lamp situated in the mast-head or side-light is automatically switched on and will remain lighted until the following morning. Fig. 1 is a front elevation,

and Fig. 2 a transverse vertical section of the indicating and alarm box, Fig. 3 being a front elevation of the same with its top or cover removed.

In the indicating and alarm box, A, there are separate compartments, A 1, A 2, A 3, to contain the mechanism required for controlling each of the three ship's lights, and as the mechanism is the same in every case the description given applies equally to each set of the mechanism. In compartments A 1 and A 3, parts of the mechanism are shown in the relative positions they occupy prior to the failure of any lamp or its connections, but in compartment A 2 they are shown in their relative positions after failure has taken place. A slab, B, of slate or other suitable non-conducting material is fixed inside the box, A, to form a base on which to fix the mechanism of the three compartments, A 1, A 2, A 3.



A positive main wire, C, leading from a dynamo or other source of electric energy, conveys current to the apparatus, and for each compartment a branch, C 1, is connected to the coils of an electro magnet, D, carried on a bracket, D 1, fixed to the base, B. The current excites the electro magnet, D, so as to attract the armature, D 2, away from the spring contact piece, D 4. The current passes from the magnet, D, by the wire, C 2, to a fusible safety connector at E, and thence by the wire, C 3, to one of the electric lamps in the signal lantern (not shown). The current returns from the lantern by a wire, F, through a hand switch, F 1, and a branch wire, F 2, joined to the main negative wire, F 3, leading back to the dynamo. Should one of these electric lamps or any of its connections fail the current through the wires, C 1, C 2, ceases, and the armature, D 2, leaves the magnet, D, and as shown in compartment, A 2, is, by the spring which carries it, made to touch the contact piece, D 4, thereby completing a separate circuit by means of the wire, G,—which is a separate branch from the main wire, C,—through a fusible safety connector at E 1, to the signal lantern. A branch wire, G 1, from the wire, G, at the same time conveys current to a small incandescence indicator lamp, H, fixed inside the alarm and indicator box, A, and lights it up. In the cover, J, as shown in Figure, 1, there is for each compartment, A 1, A 2, A 3, an aperture over which there is fixed a piece of glass, J 1, of a colour corresponding to the particular lantern with which it is in connection, and through it the light of the indicator lamp, H, is seen when lit up. The indicator lamp, H, is thus useful in showing two things, firstly, by becoming lit up, that one of the electric lamps or some part of its connections has failed; secondly, by the light it is giving out, whether or not the spare electric lamp now in use in the lantern, and its connections are in proper working order.

At the same time that the indicator lamp, H, lights up, a wire, K, in continuation from it conveys the current through a lever switch, K 1, contact piece, K 2, and wire, K 3, to an alarm bell, L, fixed outside the box, A, and causes it to ring, the return current from the bell passing by a branch wire to the main negative wire, F 3. The switch lever, K 1, is arranged so that an officer can stop the bell, L, by pushing in a button, M, fixed to a rod M 1, which acts on the lever, K 1, and shifts it from the position shown in compartments, A 1, A 3, to that shown in compartment, A 2, making it then touch a contact piece, K 4, from which a wire, K 5, is led to join the main negative or return wire, F 3, thus disconnecting the bell without disconnecting the indicator lamp, H. When the defective lamp has been repaired or renewed and the current again passes through the wires C 1, C 2, the switch lever, K 1, in connection with the alarm bell, L, is made to touch the contact piece, K 2, by a spring, N 1, the armature D 2 in closing against the electro-magnet, D, causing a lever catch, N, to release a pin, N 2, fixed in the switch lever. A spring, N 3, is provided to make the lever catch, N, engage with the pin, N 2, fixed in the switch lever, K 1, when that lever is shifted by means of the button, M.

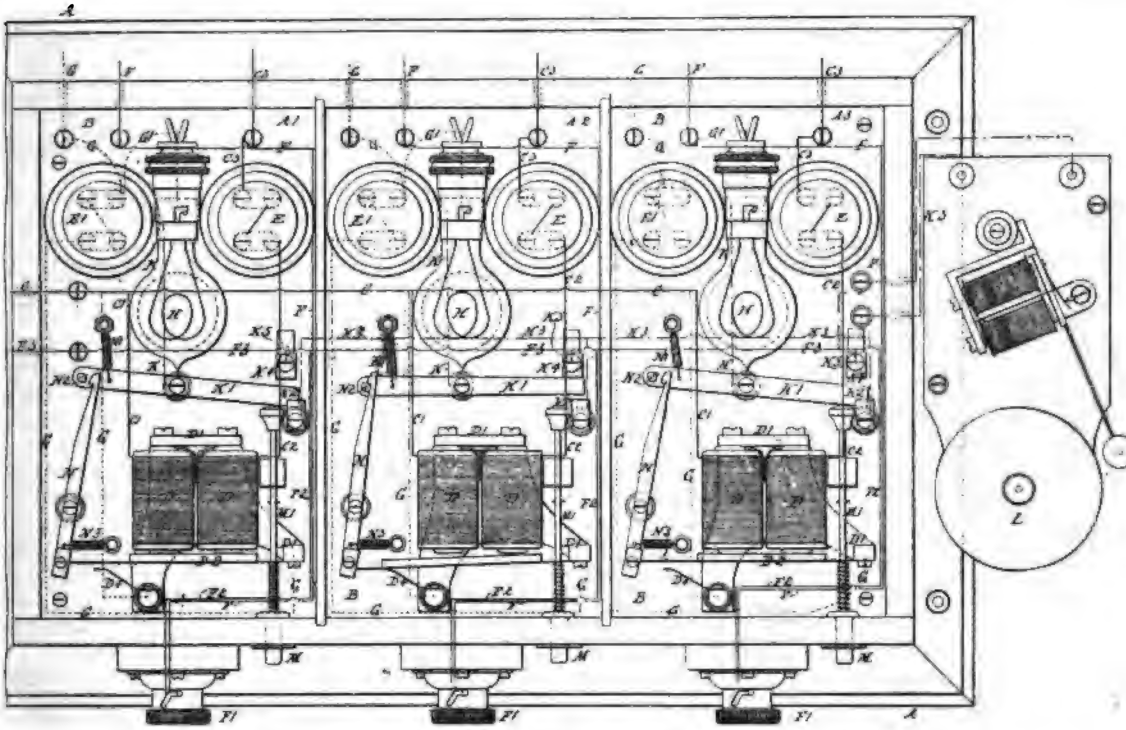
The whole action, though perhaps a little confusing on paper, is simplicity itself, and instantaneous in its action, and though only patented six months ago it has already been fitted on the following steamers:—*Sanda* and *Dungeness*, belonging to the Clyde Shipping Co.; the s.s. *Princess Beatrice*, for Messrs. M. Langlands & Son; the s.s. *Perth*, for the Dundee, Perth, and London Shipping Co.; s.s. *St. Giles*, s.s. *Cuidad de Cadiz*, &c., &c., and the patentees have had numerous letters speaking in the most flattering terms of their new indicator.

THE FASTEST PADDLE STEAMER IN THE WORLD.

On the 12th April the paddle steamer *Leopold II.*, constructed by Messrs. Wm. Denny & Bros., Dumbarton, for the Belgian Government, went her official trial trip. She is intended for mail service between Ostend and Dover, and up till now the two vessels built by the same firm, the *Princess Henriette* and *Princess Josephine*, were the fastest paddle steamers in the world, but as will be seen by the trial, they have now been beaten. The trial, which was exceptionally severe, consisted of two consecutive double runs, at full speed, between the Cloch and Cumbrae Lights, the builders being restricted in every way. They were obliged to begin the trials at a certain hour, so as to eliminate any possible tidal advantage, and the various gears had to remain absolutely untouched during the whole time of steaming. After the fourth run on the before-mentioned distance the *Leopold II.* was taken to the measured mile, where a further series of high speed runs were undertaken. The mean speed was 22·16 knots, stamping the vessel as the fastest paddle steamer in the world. The dimensions of the steamer are as follows:—Length, 340 ft.; beam, 38 ft.; depth, 14 ft. 6 in.; being 40 ft. longer and 1 ft. deeper than the steamers *Henriette* and *Josephine*. The vessel

has been fitted up almost regardless of cost, while the artistic blending of colours in the saloons is an interesting example of the rapid strides which have recently been made in the matter of interior decoration on board ship. Upon the flying bridge are the steering house and the captain's room. In the steering house is one of Brown Bros'. patent telemotors, communicating with one of their patent steam tillers, which is located aft in the counter of the vessel, in a special compartment which may be either entered from the saloon through movable panels or from the upper deck. A second steam steering station is aft, in addition to hand gear supplied by Messrs. Brown. The main engine is of Messrs. Denny & Co.s' well known paddle type, similar in design to those fitted on board the *Princess Henriette* and *Princess Josephine*, *Princess Victoria*, *Princess May*, *Duchess of Hamilton*, *Clacton Belle*, *London Belle*, &c., &c. The greater part is made either of steel or brass, the only cast-iron being in the cylinders. The high pressure valve is of the piston type, while the low pressure is a flat valve of Thom's patent. The auxiliary gear in the engine-room consists of four large double-breasted fans for the forced draft, two large-sized centrifugal pumps by Messrs. Drysdale & Co., Messrs. Weir's feed pumps, bilge and sanitary pumps and distiller, and Brown Bros'. combined steam and hydraulic starting gear. Steam is supplied to these engines by eight single-ended boilers, four in each stoke-hole. The electric light installation, which is also on the starting platform, consists of a Crompton's dynamo, driven by a Chandler engine. During the entire trial, which from start to finish lasted for nearly 12 hours, the engines worked splendidly. A noticeable fact is that little or no oil, except upon the guides, was used. All the main parts of the engine were lubricated by Stauffer lubricators, which the engineers found required little or no attention.

Charner.—On March 18th there was launched at Rochefort the steel armoured cruiser *Charner*, for the French Navy. The vessel is 329 ft. long, 46 ft. beam, and 17 ft. 8 in. deep, with a displacement of 4,745 tons. The vessel will be fitted with engines of 7,400 H.P. under natural draught, by which a speed of 17 knots is expected to be attained. The armament of the vessel will comprise two 19 cm. guns, six 14 cm. quick-firing guns, four 65 mm. quick-firing guns, six 47 mm. quick-firing guns, six 37 mm. machine guns, and five torpedo tubes.



ELECTRIC MASTHEAD AND SIDE-LIGHT INDICATOR.

LAUNCH OF A LARGE HOPPER DREDGER FOR THE BRITISH GOVERNMENT.

SEVEN months ago, William Simons & Co., of Renfrew, received an order from the British Admiralty for the construction of one of their patent hopper dredgers, and Wednesday, April 5th, it was launched complete with its engines, boilers, and machinery. It is named the *St. Michael*, and is the fourth hopper dredger the builders have supplied to the British Government.

The *St. Michael* is built to the full requirements of the Admiralty, and all the most recent improvements have been adopted in its construction.

The bucket ladder works through a stern well opening and will dredge to a depth of at least 45 ft. below the water level. The buckets have a capacity of 15 cubic ft. each and are specially designed to lift and discharge very sticky clay. A special auxiliary pumping engine is provided for washing this material out of the hoppers, shoots, &c. Steam winches having three chain barrels and two large warping ends are placed on raised platforms at the bow and stern of the dredger for handling the mooring chains and warping purpose. Each winch is driven by separate engines and the barrels all work independently. A very powerful steam hoisting engine and gearing is placed aft to raise the lower end of bucket ladder and tumbler to the deck level and thus facilitate any repairs that may require to be done thereto.

Large shoots are provided for conveying the *debris* from the buckets into the dredger's own hoppers or into barges alongside.

The *St. Michael* has two hoppers capable of containing together 600 tons of dredgings. A feature in the construction of these hoppers is that the sides are vertical. This departure from the usual sloping sides is to allow of the quick discharge of the dredged material, which is of an extremely adhesive nature, at Portsmouth Dockyard where the dredger has to work.

For the purpose of handling the vessel quickly when steering two large rudders are fitted aft, they are controlled by steam steering gear placed on the bridge forward.

The hopper doors are lifted by quick acting steam appliances as well as by hand power when required.

The vessel is propelled, and the dredging machinery worked, by two pairs of compound surface condensing engines which

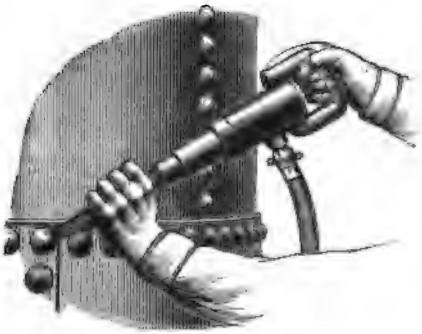
will propel it at a speed of nine knots an hour. Steam is supplied from two steel boilers constructed to Admiralty requirements for 100 lbs. working pressure.

Large and comfortable cabins fitted with berths, seats, &c., are provided for the officers and crew.

In the course of a few days the *St. Michael* will leave Renfrew for Portsmouth, where she will be employed.

ROSS'S PATENT CAULKING TOOL.

THE accompanying illustration represents a very handy portable percussion appliance for the performance of caulking, chipping, and like operations, recently patented by Mr. R. MacEwan Ross, of the firm of R. G. Ross & Son, Glasgow. The apparatus works equally well with compressed air or steam, and the ease with which the latter working agent is procurable in most workshops will probably lead to its adoption in numerous cases where a pneumatic tool is out of the question. The internal mechanism is of the simplest description, the only moving part being the striking piston, which is of duplex form, about 2½ in. in length, and made in one piece of forged steel. This piston is either 1½ in. or 1¾ in. in diameter,



according to the size of the tool, with the central portion turned down to a smaller diameter. It works in a liner cylinder, fitted into the external case of the apparatus in such a way as to leave an annular space between it and the outside casing. This space is divided into inlet and exhaust passages, for the working fluid, by suitable projections cast on the outside of the liner, and accurately turned to fit the casing. Communication between these passages and the interior of the liner cylinder is made by means of several admission and exhaust ports, so placed that the duplex piston in its reciprocating movements operates as a self-acting valve, automatically admitting and allowing the escape of the working fluid. There are thus no small valves to fire and stick, as in some forms of percussion pneumatic tools, and the piston, if occasionally lubricated, will work continuously without trouble for any length of time.

The working tool is simply inserted into a socket below the piston, without being fixed in any way, so that one tool can be instantly changed for another, an advantage practical men will readily appreciate. The working tool is kept out of actual contact with the rapidly reciprocating piston by a washer and spiral spring till pressure is exerted on the handle of the apparatus by the operator, when the piston commences to strike the tool. In the pneumatic form of his apparatus a trigger operating a piston valve placed in the holding handle starts the motion of the piston when pulled, by permitting the escape of the exhaust air. When steam is used the motion is started by simply turning a cock, and a rubber tube is employed to prevent the exhaust from inconveniencing the workman. The point of the apparatus next the working tool and the holding handle are rubber-covered to prevent contact of heated metal with the hands.

When using the apparatus the workman grasps the holding handle with one hand, while with the other he holds and guides the caulking or other tool. Notwithstanding the extremely rapid motion of the piston the vibration is so slight that it causes no inconvenience to the operator, and when a cutting tool is used the work of paring off a heavy strip of iron or steel is done so quickly and smoothly as to resemble planing rather than chipping. The caulker is made in two sizes, weighing respectively 12 and 14½ pounds, and has been already supplied with, we understand, very satisfactory results to some of the principal Scotch engineering and shipbuilding firms, as also to several of the largest railway companies.

WEIR'S FEED-WATER HEATER.

THE subject of feed-heating is one which can scarcely be said to have received the amount of attention from engineers in general which its importance deserves. In recent years, however, when economy has come to be sought for in every detail, considerable interest has been directed to the auxiliary appliances for treating the feed before its entry to the boiler. It is an almost self-evident proposition that the minimum expenditure of every simple engine is the amount of heat necessary to raise water at the exhaust temperature to steam at the boiler pressure, and even in the days of James Watt the feed supply was taken from a chamber into which the exhaust was led. As, however, the boiler pressures became higher with the advent of the compound and triple-expansion engines the chief advantage looked for by heating the feed was freedom from the injurious strains and leakage set up by the cold feed, and consequently even direct steam was used to heat the water. It was left, however, to Messrs. G. & J. Weir, Holm Foundry, Cathcart, to devise a method of feed-heating which would produce a distinct gain in the engine apart from the concomitant advantages with respect to the boiler. The system of feeding associated with the name of this firm has been applied for years to many of our largest mail and passenger steamships, and the accompanying illustrations show one of the firm's Heaters with their latest improvements. In the Weir system the heating steam is taken from the intermediate cylinder exhaust after it has performed two-thirds of its work in the main engine. If the heating steam were taken from the boiler the result would be neither loss nor gain in the matter of economy as the loss of work which might have been performed by the condensed steam would be the measure of the saving of heat. The steam,

however, which goes to the Heater in the Weir system is more effective there in raising the temperature of the water than if it were worked in the L.P. cylinder, consequently the efficiency of the engine is increased, a saving of from 6 to 7½ per cent. in fuel is obtained, and the feed water is supplied at 200 to 220° F. A feature of the fitting of this Heater is that the exhaust from the auxiliary engines, which now form a considerable number on board ship, is led to the heater, and by this means every simple engine becomes compound, and every compound becomes triple-expansion.

From a series of experiments conducted by Messrs. Weir it was found that the air admitted to the feed-water when discharged to the boilers by the main feed pumps had a highly corrosive effect on the boilers, and consequently they fitted the heater with a small air cock arrangement by which the air liberated in the heater was removed either to the atmosphere or to the condenser. The feed-water was then found to be non-corrosive, and in order that it might reach the boiler thus they also combined in their heater the float regulating arrangement shown in the section, by which the working of the pump drawing from the heater is dependent on the amount of water in the lower part of the apparatus.

A general description of the heater will illustrate the method of working. Various arrangements of the gear are fitted with or without main engine feed pumps. In the former case the main engine pumps discharge to the heater, and one of Weir's patent direct-acting feed pumps (which are generally supplied in pairs) draws from the heater and discharges to the boilers, and the steam to this pump is regulated automatically by the float in the heater. When no feed pumps are fitted on the main engines, Weir's patent feed-pumps deal entirely with the feed water. A feed tank with patent automatic float gear, similar in principle to that in the feed heater, is placed under the feed pumps, and into this the air pump discharges the feed water. One of Weir's pumps draws from this tank and discharges to the heater, this pump being regulated by the float in the tank; the other draws from the feed heater and discharges direct to the boilers, and is regulated by the float in the heater.

Fig. 1 shows an external view of the heater, and Fig. 2 illustrates a sectional view. The cold feed-water passes through the spring-loaded valve D on the cover of the heater in a thin sheet, and is at once heated by contact with the steam entering by the non-return valve on the side of the apparatus. This valve B is of special construction, and may be regulated to any desired opening; by the fitting of a dashpot, also, the closing of the valve is gradual, and any hammering due to fluctuations of pressure is obviated. A circular ring and conical spray piece with perforations are fitted in the body of the heater to mix the water and steam more uniformly. The water falls to the lower portion of the heater, in which is placed a round float-pan E with watertight bottom and sides, but open on the top. This is suspended on two levers so as to move up and down with a parallel motion, and the top lever spindle is carried through the door at one end and balanced by a lever and weight. The float is always full of water, and the weight is adjusted to an exact balance when one half of the float is immersed in the water. To the weight lever another lever is attached, which actuates the throttle valve, and controls the supply of steam to the pump drawing from the heater. When the water in the heater rises, the float is raised and the throttle valve F opened, and when the water level is lowered, the float follows and the valve is closed. The level of the water is thus kept constant in the heater, and the pumps are prevented from drawing air. The pressure on the water in the heater is always considerably less than before

Fig. 1.

it passes through the inlet valve D, and the temperature is almost instantly raised, by contact, to that of the steam. The effect of these two simultaneous actions is to cause the feed-water to give up the air and gases in solution, and these are removed either to the atmosphere or the condenser through the small cock on the air vessel on the cover. A relief valve and the usual pressure gauges are also fitted to the heater. The regulating valve F is a cock with a parallel key. The pressure of the steam keeps it perfectly steam tight, although it may have worn slack for the shell. The pressure also keeps the shoulder of the key against the bottom of the stuffing box, so that the stuffing gland is always kept slack.

The Weir system of feed-heating has been recognised by the highest authorities as a distinct factor in the efficiency of the modern marine steam engine, and the fact that the majority of the leading vessels of the Mercantile Marine are fitted with this heater is a proof of the practical success of the apparatus. We need only mention in conclusion that Messrs. Weir have fitted their heaters and also a large installation of their feed pumps on the new Cunard liners *Campania* and *Lucania*.

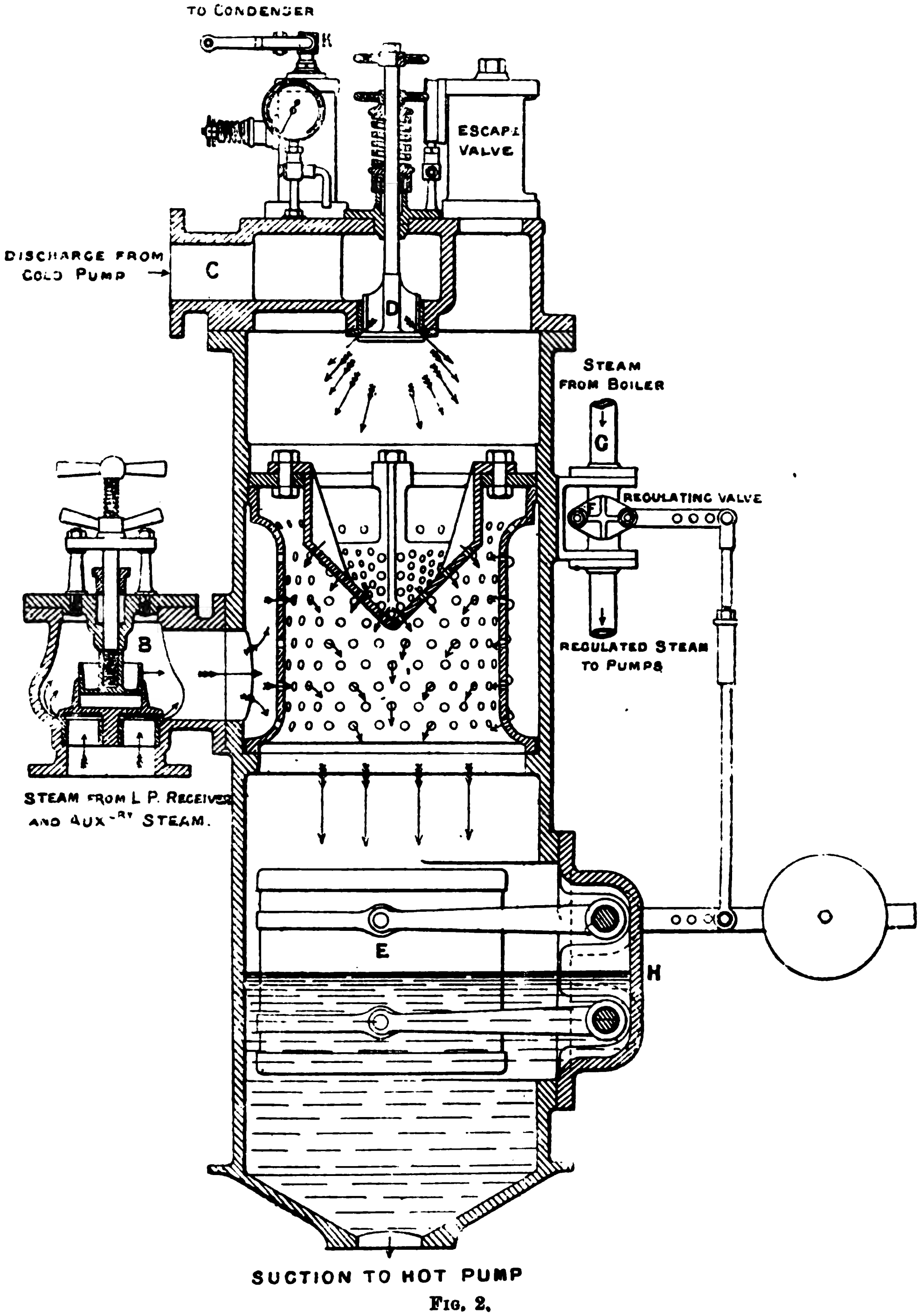


FIG. 2.

THE WHITE STAR LINER "CELTIC."

THIS well-known passenger vessel has just been sold to the Thingvalla Co., of Copenhagen, and as she leaves our shores for the last time, it may be of interest to our readers to glance at her history. She was built at a time when vessels did not "turn round" in the New York trade every four weeks. Five weeks was then the time allowed, and so to maintain a weekly service five vessels had to be constantly employed, and, of course, a sixth was also necessary as a reserve boat. The *Celtic* completed the set of six mail steamers, which were built by Harland & Wolff, of Belfast, for the original service of the line. She is

an exact sister to the *Adriatic*. This pair was 437 ft. 2 in. in length, being 17 ft. 5 in. longer than the other five vessels. The beam of all was 40 ft. 9 in., and the depth 31 ft. This extra length was given to the boiler-room, and thus the power was in excess of the earlier boats. She was launched on the 8th June, 1872, from the Queen's Island yard, and at that date her 3,867 tons of gross register made her one of the largest vessels afloat, whilst her two iron decks and seven bulkheads put her in the forefront as regards strength and subdivision. Her engines were of 600 N.H.P. by George Forrester & Co., of Liverpool, and were of the four-cylinder tandem type which had proved itself compact and economical in the earlier vessels. There were twelve single-ended boilers, with two furnaces in each. The steam pressure was 70 lbs., and the consumption about 70 tons a day. The appearance of the vessel, with her straight stem and four pole masts, with yards on fore, main and mizzen, was characteristic of the line till a very recent period, and her internal arrangements, with the saloon forward of the engines, and the open bulwarks and two tiers of deck-houses, are still followed in the building of the most modern liners.

She left Liverpool for her first trip in October, 1872, under the command of Captain Murray, now known as Sir Digby Murray, of the Board of Trade. After making some thirty-six trips she, in 1876, came under Captain Benjamin Gleadell, with whom her name will ever be chiefly associated. The first noteworthy incident of this command was the rescue of the survivors of the American schooner *Island Belle*, of Portland, Maine, in lat. 45.41 N., long. 45.30 W., on the 24th January, 1877—a performance which brought the captain a presentation and thanks from the President of the United States. At the end of 1878 the captain gave a sample of his seamanship by bringing his vessel into Queenstown under sail when her propeller worked loose. He was offered assistance by a Spanish steamer which passed him 500 miles west of the Fastnet, on the 3rd February. This was declined, and some idea of the sailing qualities of the *Celtic* may be gathered from the fact that she reached Queenstown only some twenty-four hours after the arrival of the Spaniard. In 1881 she was again the means of saving a shipwrecked crew, taking off the men from the colonial brigantine *Alice*, at two o'clock on a November morning. But the most important voyage of the vessel, and Captain Gleadell's greatest achievement, was that of December, 1883. Homeward bound, she left New York on the morning of the 15th, with 56 saloon and 120 steerage passengers. When 36 hours out, the screw-shaft broke; a heavy westerly gale was blowing, and all efforts to beat back were unavailing. On the 22nd, a Hamburg Liner came up, but the weather rendered assistance impossible. At last, on Christmas day, the vain attempt was abandoned, and the *Celtic's* head put for the Irish coast. The progress was by no means bad; on ten days she did over a hundred miles, and on one day ran no less than 178, whilst her worst day was 50 nautical miles. On the 12th January the *Britannic* came up, when she was within 450 miles of Queenstown, and on the 14th she was brought into harbour, after a passage of a couple of hours under the thirty days. This was a feat worthy to rank with that recently performed by Captain McKay in the celebrated *Umbria* incident. Circumstances had rendered the attempt to repair the *Celtic's* shaft beyond the range of practicability, and so her engineer had no chance of anticipating the fame of Chief Engineer Tomlinson. In 1886 the electric light was introduced, and the cabin arrangements overhauled. At the beginning of 1887, Captain Gleadall was promoted to the *Germanic*, and shortly afterwards his old ship made her disastrous contact with the *Britannic*. The circumstances of that case are best left untouched, but one of the results was to vacate the Commodoreship of the Line, and the *Celtic's* old commander assumed the post. As the new twin screw steamers came out, the *Celtic* and *Adriatic* went into reserve, and since the end of 1889 she has only made four trips. Her last voyage for the old owners was completed at the end of February, 1891, and she has not been out of dock since. Altogether she has crossed the Atlantic some three hundred and thirty times, and has throughout maintained a reputation for comfort. Like most of her family, she has waited till at least middle life to show her best paces. The 135th voyage in July, 1887, was her best in both directions, and curiously enough, the two trips were within a quarter of an hour of one another, her time being 7 days, 21 hours, 35 minutes out, and 7 days, 21 hours, 20 minutes homewards. Her sister, the *Adriatic*, was the speedier of the pair, and held the Atlantic record in their day, and until the advent of the *Britannic* and *Germanic*. Nevertheless, in the early seventies, these performances of the *Celtic* would have placed her before even the *Adriatic*, and given her a right to the record in each direction.

THE LAND OF THE "MIDNIGHT SUN." A NEW MAIL AND TOURIST STEAMER.

THE growing popularity of the Norwegian Fjords and scenery as an attractive resort for pleasure-seekers in the summer and autumn months has naturally given rise to a spirit of enterprise with the view of meeting the requirements of modern times, the latest outlet to which is the *Venus*, a swift and beautifully modelled steel screw steamer, built to the order of Det Bergenske Dampskibsselskab, by Messrs. C. S. Swan & Hunter, Wallsend. The new steamer, which has been constructed under the personal superintendence of Mr. G. Lie, official inspector for the company, measures 240 ft. in length, 31 ft. 4 in. in breadth, and 21 ft. 10 in. in depth. She is constructed on the spar-deck type, and has been assigned the highest possible classification at Lloyd's and the Norwegian Board of Trade requirements, which are known to be exceptionally stringent. Her water-ballast arrangement is on the cellular double bottom principle, extending the entire length of the ship; her shell, numerous watertight bulk-heads, and decks being of steel, the latter being cleaded with pitch pine, upwards of 3 in. in thickness. She is rigged as a topsail schooner, and as her masts and funnel have an exceptionally large rake, the craft presents a very smart appearance. Special attention has been paid to the requirements of the trade for which the vessel has been specially designed—the Norwegian Royal Mail and passenger service between the Tyne and Bergen and yachting cruises, to the chief fjords in Western Norway, her dimensions being such that she is able to reach the head of these majestic fjords and also to take all the inner channels on the Norwegian coast, the importance of which cannot be over-estimated in such cruises, and every comfort and luxury afforded by the latest developments in naval architecture has been introduced in the construction of the *Venus*. Her state-rooms form a distinct speciality of the ship; all being on the main deck and not more than two berths in each, chiefly placed in the favourite long-ships position. The furnishings, sofa seats, washstands, mirrors, glass racks, &c., are of solid mahogany. The upholstery throughout is of exquisite design, and of the richest material, all seats and sofas being fitted with coppered steel springs, closely set, and overlaid with a thick layer of hair. The curtains and drapery in the saloon, entrance hall, ladies' boudoir, music-room, and all berths are in rich colours, heavy and tasselled. The officers' berths are furnished in the same style as the first-class cabins, and for the greater comfort and safety of the passengers, the vessel is lined between the panelling and the shell with two thick courses of wood, with felt, and in some places a lay of charcoal between. The dining saloon, which is on the main deck, is a magnificent apartment, extending the whole width of the ship, is equal, in point of luxury, to the best passenger steamer afloat; the revolving chairs with which the vessel is supplied being upholstered in old gold and crushed velvet; the panelling and carving in alternate shades of light and dark oak, juniper, maple, Hungarian-ash and walnut, producing a very fine effect. The sideboards are beautiful specimen of works of art, the marble tops encircled by rails of plated silver, forming a striking contrast to the antique carving introduced. In the fore part of the saloon a large mirror and timepiece are placed, both encased in massive frames of tastefully carved oak. In addition to a complete installation of electric light, with symmetrical incandescent lamps in fittings of plated silver, extending through all state-rooms, berths, saloon, smoke-room, and to the engine-room and tunnel; there is also a full equipment of silver-plated oil lamps in the saloon, music room, smoke-room, ticket office, post-office, and in all the state rooms and cabins, besides swing candlesticks of the same costly material. The post-office is on the main deck amidships, the furniture being of solid mahogany relieved with panelling of a lighter tint. Writing-desks, carved lockers, wardrobe, chest of drawers, and sofas are provided, and every facility is afforded passengers of transmitting letters frequently. Elegant railway netting is provided in all berths, tourists' cabins and state-rooms, and the surroundings of the ship, and the pleasure attendant on a trip with the *Venus* is much enhanced by the

all-round excellence of the get-up, the fittings throughout being of burnished silver plated. The electric bells, with which every berth, tourists' cabins and state-rooms are provided, are so arranged that passengers lying in their berths can communicate promptly with the officers on duty. The principal skylight, which is placed immediately over the dining-saloon and entrance hall, is exceptionally large and airy, with ornamental semicircular embellished glass top, and saddled seats on both sides of the exterior, with tastefully carved figure ornaments, flowers and plants being arranged in the dome below. Entrance to the saloon is obtained from the spar deck by a serpentine corridor, well-lighted and with massive balustrades of solid mahogany artistically carved. Warmth is obtained when desirable by a patent system of steam heating, extending under all side tables to the saloon, ladies' rooms, officers' and seamen's berths, post office, &c. All deck-houses are of iron, and firmly attached to the beams underneath, and protected on the outside by massive panelled framing of varnished teak.

The exceptional height between the decks will add considerably to the comfort of the passengers, and heighten the pleasure attendant on a run across the North Sea, and a cruise among the enchanting fjords, while the improved and perfect system of ventilation, which extends to every state-room, cabin, and berth, will conduce to render a voyage with the *Venus* of the most exhilarating character.

The smoke-room is on a level with the spar deck, its internal furnishing being of polished hard wood of alternate colour of the same quality and design as the saloon and state-rooms, but of a more subdued tint. The full complement of life-buoys and belts are provided in accordance with the Board of Trade requirements, and special precautions have been taken against the outbreak of fire, patent steam extinguishers being provided in case of emergencies. The water service equipment is perfect, all the latest improvements having been introduced, brass storm valves being fitted, and drain pipes from the mahogany washstands in the state-rooms and berths leading down to the water line. Several bath-rooms are provided with hot and cold water supply, together with shower bath arrangements, and valves and other fittings being of plated silver, the mirrors, wash stands, and other furnishings being in keeping with the surroundings of a first-class hotel. The ladies' boudoir and music-room are superbly furnished, and a costly piano fitted. The spar deck is entirely open for promenade purposes from stem to stern, the lifeboat, cutter, and other boats with which the vessel is equipped, being on the deck above.

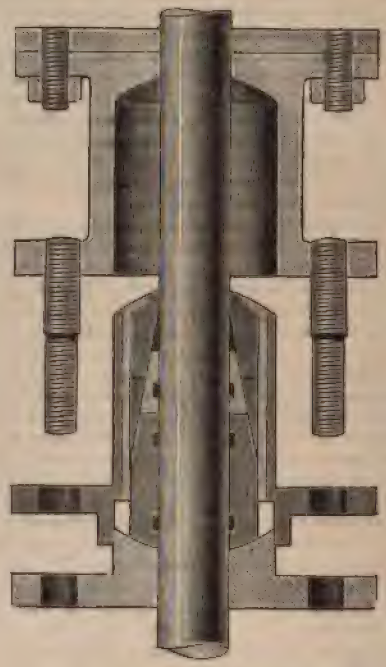
The promenade deck, which is placed immediately over the deck-houses, will, from its breezy position, present an excellent point of vantage from which passengers can command an admirable view of the charming scenery which characterise the fjords and inlets on the coast of the land of the midnight sun.

The engines, which have been built by the Wallsend Slipway and Engineering Co., Limited, are on the improved triple-expansion type, and are exceptionally powerful and calculated to render the *Venus* the swiftest steamer in the Norwegian tourist and mail service.

The behaviour of the craft in a succession of runs over the measured mile off Tynemouth Castle was the subject of much favourable comment by the experts on board, a speed of 14½ knots per hour being obtained, the machinery working smoothly and without perceptible vibration.

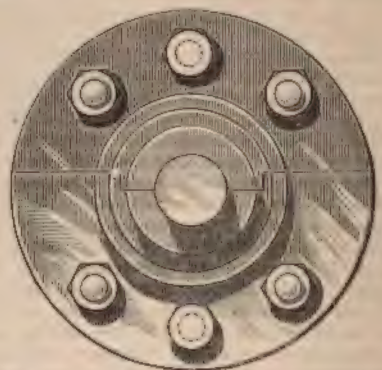
STARNES' IMPROVED STUFFING BOX.

It is somewhat remarkable that, considering the amount of ingenuity and thought that has been devoted to the subject of the packing of glands, that little or nothing of a practicable nature has been done to improve the method of packing, apart from the packing *per se*; and it is perhaps needless to remark that the inventions relating to packings of every kind and form are legion, the very prolific propagation of ideas in this direction being brought about by the wants felt, and difficulties experienced, owing to the great rise in boiler pressures that has taken place by the introduction of triple-expansion engines. We can, however, present to our readers a new stuffing box, that can lay claim to considerable novelty, inasmuch as it deals essentially with the method of packing. This invention is being put upon the market by Messrs. J. S. Starnes & Sons, of Broad Street, Ratcliff, under the title of the "Improved Packing Sleeve," and is illustrated in the accompanying engravings. In using



the invention, no interference is made with the packing, as any class of packing can be used in it.

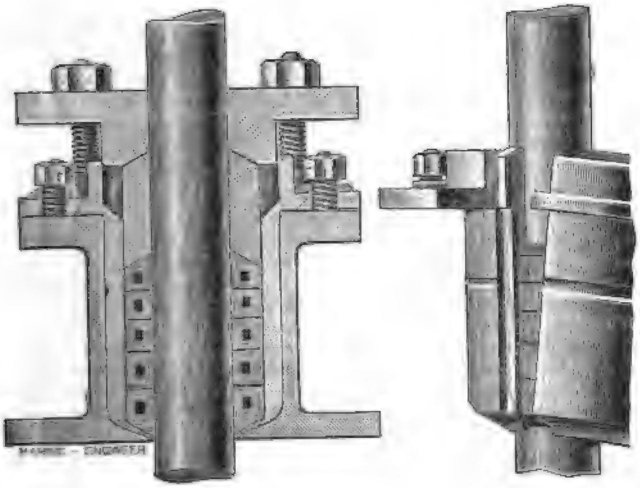
In the means hitherto adopted for the removal or repacking of stuffing boxes, much valuable time is lost, which in many cases is a drawback, and applies especially in the case of marine engines; the object of the invention is to overcome these difficulties. As will



be seen from the illustrations, the sleeve is made in halves, being divided in the direction of its length, and made exactly to fit the stuffing box, and to suit whatever packing may be required for rods, shafts, or hydraulic rams, &c. The advantages claimed for this system of stuffing box, are:—that a saving of at least 33 per cent. is effected in the amount of packing required; that no packing screws or drawers are

necessary for drawing old packing; that the packing can be seen without disturbing or injuring it, simply by withdrawing the sleeve, removing one half of it and examining the packing; that packing of any sort can be used to repack; that a great saving of valuable time is effected in drawing out old packing and re-packing again; that any stuffing box can be fitted with this sleeve without alteration to stuffing box or gland; and that the sleeve being in halves, it is easily fitted and removed without injuring rods, spindles, and other adjacent parts.

It is further claimed by Messrs. Starnes, that if this sleeve is fitted to stern shaft stuffing boxes, it would



show a great saving of packing, and produce a far superior result to the present arrangement, for if the tail shaft wore down to any extent, then both the sleeve and the packing could be drawn and reversed, and indeed, the same advantage would hold good for all horizontal work, whether marine, locomotive or otherwise. It appears to us that the advantage likely to accrue from this invention in dealing with troublesome stuffing boxes at sea is very considerable, as it is of course of utmost importance that the packing of a gland can be done in much less time and much more efficiently than as at present in packing ordinary stuffing boxes with such heavy packing as now in use.

STEAM-ENGINE TRIALS.

At the ordinary meeting of the Institution of Civil Engineers, on Tuesday, the 11th April, Mr. Harrison Hayter, President, in the Chair, a Paper was read giving a detailed account of the last series of "Steam-Engine Trials" undertaken by the late Mr. P. W. Willans, M.Inst.C.E.

The Paper dealt with an extensive series of condensing trials made with a 40 I.H.P. Willans Central-Valve Engine. These were intended to form a sequel to the investigations described in the author's papers, entitled, "Economy Trials of a Non-condensing Steam-Engine, Simple, Compound and Triple," read before the Institution in 1888 and 1889. The principal objects in undertaking these trials were—(1) To ascertain the initial condensation in the first cylinder, and to trace the behaviour of the steam in the succeeding cylinders, when working as a compound or triple-expansion engine; (2) To observe the effect of speed of rotation, area of exposed surface, and range of temperature, upon the initial condensation, and upon economy generally; (3) To ascertain the percentage of the theoretical mean pressure actually obtained; (4) To ascertain the ratio of the work done by each pound of steam to the theoretical work due from it; (5) To determine the consumption of steam at all loads, and under various conditions.

The consumption of steam was determined by discharging the condensed water from the exhaust into a tank carried by a weigh-bridge, and observing the intervals of time required for fixed weights of water to run in. By this method, a continual watch was kept on the performance of the engine during the whole trial, and any disturbing cause was immediately detected; leaky steam-pipe joints did not affect the result, and the length of the trial might be much reduced. Special experiments, made to ascertain whether any addition was necessary to cover leakage in the engine and exhaust-pipe, showed that this leakage was slight.

The method of determining the theoretical work due from one pound of saturated steam when discharging into a condenser was next considered, and it was shown that the thermal efficiency of a condensing engine must of necessity be less than that of a non-condensing engine, owing to the greater proportionate size of the "toe" of the diagram cut-off for practical reasons. In the non-condensing trials the best number of expansions was computed from the approximate formula $p^6 v^7$=constant; but for the condensing trials the error in this could not be neglected. The best ratio of expansion and mean pressure were therefore calculated for adiabatic expansion by Mr. McFarlane Gray's $\theta\ \phi$ diagram, combined with a volume curve. Altogether 62 trials were made under various conditions of speed, steam-pressure, load, and ratio of expansion, as well as with the engine working simple, compound, and triple, and the results were embodied in the tables accompanying the paper.

One of the principal deductions from these experiments was the "straight-line" law of steam-consumption; and it was shown by diagrams that the *total* water for the horse-power corresponding to any mean pressure P, was W+K P., where W was the water which would be used by the engine at zero mean pressure (through initial condensation, radiation and conduction), supposing it were frictionless, and K was the water per hour required to produce each pound of mean pressure. These factors were shown to vary with the conditions under which the engine was working.

Eighteen of the trials were planned to assist in determining the law connecting initial condensation with revolutions; and it was found that in the high-pressure cylinder at high mean pressures the total condensation per unit of time was directly proportional to the square root of the number of revolutions per unit of time. As the mean pressure was diminished, the condensation became more and more nearly constant at all speeds; and finally, at low mean pressures, the law appeared to be reversed. For the low-pressure cylinder the law was modified.

The important question of changing the proportions of steam and water present during the expansive part of the stroke was investigated by the $\theta\ \phi$ diagram. The matter was first examined theoretically by considering the effect of a thin liner of infinitely conducting matter, and a curve was drawn on the $\theta\ \phi$ diagram showing the rate at which the steam initially condensed in warming up the liner from the exhaust to the initial temperature was re-evaporated as the expansion proceeded. The actual re-evaporation, as obtained by measurement of the indicator cards was compared with this theoretical re-evaporation, the difference measuring the delay in the return of the heat from the liner to the steam. The losses due to the conduction and radiation, to passage through ports, and to incomplete expansion, could also be shown on the $\theta\ \phi$ diagram.

The question of the economical advantage of reducing the power by automatic cut-off *versus* throttling was discussed. Broadly, the result was that the gain by varying the expansion was large for a simple engine, moderate for a compound engine, and, for a triple engine, almost inappreciable. It further appeared that the gain at high speeds was greater than at low speeds.

A few trials made with the cylinders steam-jacketed showed a slight gain, but further experiments were required to show whether the gain was likely to be worth the extra trouble and expense involved.

The missing steam at cut-off varied in the trials to even a greater extent than it did in the non-condensing trials—the amount being much affected by the range of temperature, the density of the steam and by other conditions.

It appeared that under all circumstances, the triple-condensing engine showed an advantage over the compound in regard to

steam-consumption; but that, except for very large engines, the compound-transfer engine was probably the best for pressures qelow 150 lbs. (absolute) pressure per square inch.

HOPPER DREDGER "MUD TURTLE."

THE accompanying illustration represents the Screw Hopper Dredger *Mud Turtle*, which has recently been built at Renfrew, to the order of the Indian Government. She has been specially constructed by her builders, Messrs. Simons & Co., for the dredging in H.I.M. dockyard at Bombay, and embodies all the most recent improvements in this class of craft, whilst as a sea-going vessel it is only necessary to state that the passage from the Clyde to Bombay was made under her own steam in forty days.

The hull is built of steel, and is divided into eight water-tight compartments. The principal dimensions are:—Length, 175 ft.; breadth, 35 ft.; depth, 14 ft. 6 in. She has two sets of triple-expansion engines of 600 collective I.H.P., steam being supplied by two steel boilers having a working pressure of 150 lbs. per square inch. The dredger has a speed of over 9 knots an hour, either set of engines being capable of working the bucket. There are two sets of buckets provided, a large set for working in sand and soft material, and a small set fitted with ripping picks are substituted when hard material has to be dealt with. The builders have constructed the *Mud Turtle* with their patent traversing bucket ladder, which admits of the buckets cutting in advance of the hull, also of the buckets and lower tumbler being hoisted to deck level. Powerful triple-barrelled winches are provided at the bow and stern for working the mooring chains, and steam hoisting engines at the bow for raising the lower end of the bucket ladder, which is arranged to dredge to a depth of 30 ft. below water level. Steam steering gear is provided, whilst there is ample and well-ventilated accommodation for the officers and crew, the European and native crews being housed separately on deck. The *Mud Turtle* was constructed under the direction of Sir A. M. Rendel, K.C.I.E., of Westminster.

NAVAL MATTERS—PAST AND PROSPECTIVE.

APRIL—MAY.

(*From our own Correspondent.*)

THE NEW PROGRAMME.

THE financial year has not come in with any event startling to the naval world, and the most important note to make is of the constitution and distribution of the vessels of the new programme. This comprises two battleships, two first-class cruisers, three second-class cruisers, two sloops and 14 torpedo-boat destroyers. During the year all but nine of the 70 ships ordered under the Defence Act of 1889, are to be completed, and these nine ships will only need an expenditure of £283,000 to complete them. The battleship *Renown*, laid down last year at Pembroke will be forwarded, and in addition six torpedo-boat destroyers and ten torpedo-boats ordered last autumn will be made ready for trial during the summer. One must not omit from the programme some useful work of reconstructing the older types of warships. The *Devastation* will be completed, and the *Monarch* and *Sultan* advanced The repair of the *Agincourt* and *Northumberland* will also be begun. It has been strongly urged by some of our most experienced naval officers that this last-named class, when reboilered and modernised, will play a useful part in convoying the slower merchant ships in wartime.

THE "RENOWN."

This new battleship, which is being constructed at Pembroke Dockyard from designs by Mr. W. H. White, Director of Naval Construction, was mentioned but not described by Lord George Hamilton last year. Lord Spencer has given some further particulars, but we are yet without anything like a detailed description of the methods by which it is proposed to give to her, armoured or other protection. Her normal displacement will be 12,350 tons, or 1,850 tons more than that of the *Centurion*, and 1,800 tons less than that of the *Royal Sovereign*. On this displacement she will carry four 10 in. B.L. guns in two barbettes, mounted similarly to those in the *Centurion*, and a secondary armament of ten 6 in. quick-firers, and 20 small quick-firing guns. The barbette armour will be thicker than that of the *Centurion* and the system of protecting the secondary battery will be similar to that adopted with the 6 in. quick-firers of the *Royal Sovereign*. The *Renown* will be wood sheathed, provided by contract with engines of 10,000 H.P., to give a speed of 17 knots on the eight hours natural draught trial, and a maximum speed of 18 knots with moderate forced draught.

THE "MAJESTIC" AND "MAGNIFICENT."

These two battleships of the new programme will be built at Portsmouth and Chatham respectively. They will exceed the *Royal Sovereign* in tonnage, and will be 390 ft. in length with a beam of 75 ft. They are to be armed with four 12 in., 46 ton guns, twelve 6-in., and 28 smaller quick-firing guns. Their machinery of 13,000 H.P. to give 18 knots, forced draught, and 16½ knots, natural draught, will be contracted for. While in general appearance these vessels will somewhat resemble the *Royal Sovereign* class we may expect that they will show considerable modification in the principle of giving armoured protection. On the *Majestic* £81,912 will be spent during the year ending 31st March, 1894, and on the *Magnificent*, £179,509 in the same period.

THE NEW SECOND-CLASS CRUISERS.

Three of these vessels are to be built in the public yard. They are improvements upon the *Astræa* class described below, and will be of 5,500 tons displacement, 350 ft. length, 53 ft. beam, and 20 ft. mean load draught. The engines, which are also to be built in the dockyards, will be of 9,600 H.P. at forced draught, giving a maximum speed of 19·85 knots, and 8,000 H.P. at natural draught, with a speed of 18·5 knots. They will each carry five 6-in., six 4·7-in., and nine smaller quick-firing guns. About £28,000 is to be spent on the *Talbot* at Devonport, the same amount on the *Minerva* at Chatham, and £16,734 on the *Eclipse* at Portsmouth. What is particularly noteworthy about these new cruisers is their length, some 30 ft. more than that of the *Astræa* class. It is probable that a greater sea-speed is anticipated as a result of this increased length, for it is well-known that short ships cannot be made, except at great expenditure of power, to maintain a pace in heavy or even moderate rough water.

THE NEW SLOOPS.

These are to be named the *Torch* and *Alert*, and will be built at Sheerness, engines included. They are to be improvements upon the *Goldfinch* class of gun vessel, and will be used on foreign stations. They will be 960 tons displacement, 180 ft. in length, 32 ft. 6 in. beam, and 11 ft. 6 in. mean load draught. Engines of 1,400 H.P. with forced draught will drive them 13·25 knots, and 1,050 H.P. natural draught will give a sea-speed of 12·25 knots. The armament will comprise six 25-pounder and four 3-pounder quick-firing guns. Something between £12,000 and £13,000 will be expended upon them during the financial year.

THE "TERRIBLE" AND "POWERFUL."

Of the two first-class cruisers which are to be put out to contract, and upon the construction of which £120,000 is to be spent before April, 1894, nothing very definite is yet known. Tackled upon this matter, the Secretary of the Admiralty, in the House of Commons, and Lord Spencer, in the Upper House, have refused to give particulars, alleging that it is more politic not to give the information until the arrangements are so fully complete as to obviate the chance of foreign Governments forestalling us. This attitude is generally looked upon as an admission that the

Hopper Dredger "Mud Turtle" constructed by Messrs. Simons & Co., Renfrew (*see page* 66)

designs of the vessels are not yet ready, since it is well-known that if they were, foreigners would be pretty sure to obtain them, despite all precautions. All that Lord Spencer could be made to say, was, that they are to embody the results of experience gained with our existing cruisers, and in speed, coal supply, armament and protection, to surpass anything of the kind built and building. The heaviest cruiser building is the Russian *Rurie*, of 10,923 tons displacement; the fastest, the Argentine *Nueve de Julio*, which made a mean of 22·74 knots with forced draught; the United States *Columbia* can stow 2,000 tons of coals; while the French *Dupuy de Lome* is completely covered with armour. There is, therefore, ample scope for the talent and ingenuity of Mr. W. H. White, and there is not the slightest question but that he will be equal to the occasion. That the new vessels will be battleships in everything but name is also matter of very little doubt.

The Torpedo Flotilla.

Ten boats of 140 ft. in length, now being constructed, should compare favourably, as regards speed, habitability, and handiness with anything of their kind; they will all be ready for trial very shortly. Of the 20 torpedo boat destroyers of 27 knots speed, six are already in hand, and will be completed during the financial year. Messrs. Thorneycroft will have the *Daring* ready for trial in July next, and the *Decoy* in August. Messrs. Yarrow will follow with the *Hornet* and *Havoc* in October, and Messrs. Laird will turn out the *Ferret* in February, 1894, and the *Lynx* a little later. The length of these new vessels will be 180 to 185 ft., beam 18·5 to 19 ft., and draught about 5 to 6 ft. The proposed armament is one 12-pounder, new Elswick pattern, three 6-pounder quick-firing guns and three torpedo ejectoring tubes. The engines will be about 3,500 H.P., and at normal draught the coal capacity about 60 tons. At present it has been decided to give them crews of 40 officers and men. Although 27 knots is spoken of as the maximum rate, a sea speed of from 23 to 24 knots is all that is anticipated and hoped for in the first vessels finished, but as torpedo boats of 30 knots speed are already projected, it is obvious that before we get the twenty Destroyers the standard of speed will have to be raised considerably.

Launch of the "Astræa."

This event took place at Devonport on the 17th ult. She is one of the improved second-class protected cruisers of the Defence Act. Her dimensions are:—Length, 320 ft.; beam, 49 ft. 6 in.; mean draught 19 ft. normal; displacement, 4,360 tons; complement 289 officers and men. Her armament will comprise two 6 in., eight 4·7 in., nine 6-pounders, and nine 3-pounders, quick-firers. The engines, built at Devonport, are to develop under forced draught on a continuous sea trial of four hours 9,000 H.P., and with ordinary draught 7,000 H.P., giving estimated speed of 19·75 knots and 18·25 knots respectively. The coal capacity is 400 tons. It is expected that she will be completed for sea during the year.

Trial of the "Barham."

This vessel, which has been the cause of much heart-burning, has at length made satisfactory steam trials, and will be commissioned May 2nd to relieve the *Landrail* in the Mediterranean. The eight hours' trial was made April 12th, the tubes of her boilers having been previously ferruled and the ship fitted with a new set of fans in place of those which failed at the last trial. The engines developed 3,589 I.H.P. and a log speed of 18·91 knots, the average pressure in the boilers being 131 lbs. and the air pressure 1·3 inches. On April 15th a forced draught trial took place, when for three hours the vessel averaged 20·8 knots by patent log, developing a H.P. of 4,538, which is the highest speed and power she has yet obtained. The pressure in the boilers was 137·5 lbs., with an air pressure of a little over two inches. This is a marvellously successful demonstration of the value of the ferruling process, the credit for which belongs to Mr. Edward C. Peck, of Messrs. Yarrow's firm at Poplar, and to Mr. Oram, R.N., of the Admiralty.

Portsmouth Dockyard.

Three vessels have been delivered at this yard by the contractors to be completed. On April 2nd the first-class cruiser *Gibraltar* from Messrs. Napier's, where she was commenced December 2nd, 1889; on April 3rd, the *Ramillies*, one of the first-class battleships of the Defence Act, from Messrs. J. & G. Thomson; and on April 9th the *Endymion*, first-class cruiser, from Messrs. Earle's yard at Hull. The *Ramillies* was only laid down at Clyde Bank in August, 1890, so that she beats the record for rapid construction of armoured battleships in private yards. She is to be at once prepared for trials and commission. The *Gibraltar* and *Endymion* are unsheathed cruisers, sister ships to the *Edgar*, which recently went to the Mediterranean to relieve the *Undaunted*. The *Vulcan*, like the *Barham*, has made satisfactory trials, and the other vessels in hand here are the *Centurion*, battleship, *Crescent*, first-class cruiser, and *Fox*, second-class cruiser. The last-named vessel will be launched June 15, when the *Eclipse*, of the new programme, will take her place on the stocks. The *Sultan* has been taken in hand for a thorough repair, and the *Repulse* is completing here. Two new docks are to be built at this yard, each 500 ft. in length, and fit for constructing or repairing the heaviest ships afloat or proposed. This work will be given out on contract, and tenders will be called for almost immediately.

The Coastguard Reserve.

These vessels have proceeded to their respective dockyards for a six weeks' repair and overhaul, the *Alexandra*, *Invincible*, and *Iron Duke* going to Portsmouth, the *Belleisle*, *Neptune*, *Rupert*, and *Shannon* to Devonport, and the *Audacious* and *Hotspur* to Chatham. For the annual refit of these vessels a new departure has been adopted. The defects, which have hitherto been made good by Dockyard labour, are now being done by naval shipwright artificers of the Dockyard Reserve. The economical advantage of this arrangement is that whilst these men are employed, the cost of material is the only expense incurred, for belonging to the Navy, their pay would be the same whether employment were found for them or not. Several of these vessels will be relieved before the end of the financial year by ships of newer type. The *Colossus* will take the place of the *Neptune* at Holyhead, the *Edinburgh* that of the *Audacious* at Hull; these vessels, with the *Alexandra* and *Superb* representing the line of battle. Then the *Invincible* and *Iron Duke* at Southampton and Queensferry respectively, will be relieved by two belted cruisers of the *Undaunted* class, the *Shannon* at Bantry by a cruiser of the *Edgar* class, and the *Belleisle* and *Hotspur* at Kingstown and Harwich by two second-class cruisers. When these changes have taken place there will be with the Portguard ships and Gunnery tenders, a reserve fleet of eleven battle-ships, and five cruisers always ready for service at home.

New Coaling Stations.

The construction of a thoroughly efficient coaling station, which has extended over three years, has just been completed at Portsmouth at a cost of about £40,000. Hitherto the coaling of ships at our principal ports has been accomplished by means of sacks and baskets—a laborious and slow process. The objections to the system having been repeatedly pointed out, at length the Admiralty set about establishing a modern coaling station at Portland and at Portsmouth. Nothing has yet been attempted at Chatham or Devonport. The coaling station at Portsmouth has been formed on a point of land on the north side of the tidal basin, and has a capacity for storing 50,000 tons in a pile 10 ft. high. The plant for receiving and discharging the coal consists of ten hydraulic cranes, capable of lifting 30 cwt. and so placed as to allow trucks to pass under them. There are also two coal hoists, and the requisite number of hydraulic capstans, and two pairs of surface condensing engines. The hydraulic cranes and hoists are worked at a pressure of 700 lbs. to the square inch, and are connected with hydrants by telescopic tubes. Each crane has a span of 50 ft., turns on a pivot, and can be moved about on lines of rails by means of winches. The cranes will be exclusively used in loading and discharging sea-borne coal, and the hoists for filling ships rapidly with laid coal when colliers may not find it safe to trade. In such cases the coal waggons will be lifted bodily upon the platforms of the hoists, tipped to the required angle by the hydraulic cylinders, and their contents discharged through shoots into the warships. It is estimated that each crane can load and discharge at the rate of 50 tons an hour, and it is proposed to coal battleships by means of lighters, which will be loaded with bags by the cranes.

Ships Commissioned or Paid Off.

The experiment of bringing home a vessel from the Mediterranean to recommission her, tried in the case of the *Collingwood* in March, does not seem to have been satisfactory to the authorities, for the new crews of the *Victoria* and *Trafalgar* have been sent out in the cruiser *Achilles*. The *Royal Arthur*, flagship for the Pacific, which left Portsmouth in April, has been reported from Madeira, and is to be at Valparaiso next month to relieve the *Warspite*. The surveying steamer *Research* was re-

commissioned April 1st by Captain Hon. F. Vereker, and will now undertake a survey of Spithead. A surveying officer has also been ordered to make a fresh plan of Plymouth Sound, and Commander Richards, who has hoisted his pennant in the *Triton*, will go over the ground at the entrance to the Thames and Medway. These resurveys are called for by the increased draught of the new ships, and by the discovery of pinnacle rocks in Milford Haven and the fair way to Liverpool. The yacht *Lancashire Witch* having been purchased by the Admiralty for use as a surveying vessel, has been renamed the *Water Witch*, and will be prepared for service at Portsmouth. The *Wanderer* and *Lark* sloops have been commissioned as sailing training ships, the latter for the Mediterranean, where she will take the place and bear the name of the *Cruiser*, the former in the Channel as tender to the *Boscawen* and *St. Vincent*. New crews have been dispatched to the *Swallow* and *Magpie*, which vessels will be recommissioned abroad.

Chatham Dockyard.

The number of workmen now employed here is higher than at any previous period of the yard's history. There will soon be five battleships in hand. The *Empress of India*, built at Pembroke, is completing, and all her armament having been delivered, she is to be ready for the pennant by the end of June. It is said that she will be the cheapest of the nine first-class battleships of this type, costing £23,000 less than the *Royal Sovereign*. The *Barfleur*, another new battleship, is to be completed by this time next year. The *Monarch* and *Agincourt* are being extensively repaired, the former receiving new triple-expansion engines and boilers, the latter new boilers. On the slip from which the *Barfleur* was launched, the *Magnificent* will be built. A sixth battleship, the *Ajax*, after extensive refit, covering a period of 18 months, has been passed into the Fleet Reserve, and is ready for commission. The only cruiser building is the *Forte*, but to her will shortly be added the *Minerva*. The engines for both these vessels will be made in the yard, and those for the *Forte*, of 9,000 H.P., the first to be built here, are to be finished in July next. The *Scylla* has been passed into the "A" Division of the Fleet Reserve, the *Arethusa* is preparing for a Mediterranean commission, and the *Pylades* for service in Australia. A new torpedo-gunboat, the *Dryad*, has just been commenced, and is to be completed for the pennant within twelve months.

The Repairs of the "Apollo."

This vessel, after a repair necessitated by her disastrous adventure at the Skelligs during the manœuvres of 1892, has been once more passed into the Fleet Reserve as ready for sea. The damage done to the ship could not have been worse had a torpedo exploded near her skin, and that she is fit for service again in less than six months speaks volumes for the soundness of her construction and the good qualities of the steel plates and frames employed.

The late President of the Institution of Naval Architects, in his valedictory address, and Sir Nathaniel Barnaby, in a letter to the Press, have also borne testimony to the excellence of the material provided by contract for the construction of this vessel and the workmanship of her dockyard builders.

The "Undaunted" Mishap.

Lord Charles Beresford is one of the most capable as well as one of the most popular officers in the Navy, and therefore a feeling of surprise almost eclipsed that of regret when the news arrived that his cruiser, the *Undaunted*, had touched the rocks when leaving Alexandria on March 21st. A court-martial was held at Malta to investigate the circumstances, when it was shown that the mishap occurred owing to the navigating officer giving a wrong order. The passage is very narrow, and the officer who was conning the ship sang out "Port" when he meant "Starboard," and his orders being at once obeyed, the vessel sheered over the wrong way and touched the ground. As a result of the trial, Captain Lord Charles Beresford was acquitted, but Staff-Commander Richards, being found somewhat in fault, was ordered to be more careful in the future. The ship has been placed in dock and her injuries, which are not serious, are being repaired. Some 20 ft. of plates will have to be removed, as they are badly bulged in where the ship bumped under her fore-bridge, and run to within 150 ft. of the rudder-post. There is a deep bulge in line with her boiler-room on the port side, but the damage is mostly in the framework in the double bottom. The *Undaunted* was about to return to England to pay off, and this programme will be carried out as soon as she is temporarily repaired.

Devonport and Keyham.

The *Antelope* gunboat was to have taken the water at this yard during April, but a defect having developed in her shafting, will delay the event for some time yet. Her boilers are being placed on board. The contractor's engineers are still at work here on several of the new vessels, of which the cruisers *Sybille*, *Retribution*, *Pique* and *Æolus* are all preparing for trial. The cruisers *Bonaventure* and *Astræa* are completing, and the coppering of the wood-sheathing of the former vessel is looked upon as rather a smart job, 5,000 sheets of copper being fixed in position in less than three days. The work was done under the job and task system. The *Hermione*, cruiser, is being pushed, and the gunboats *Halcyon* and *Harrier* are in a forward state; as soon as one of these is launched, a new cruiser, the *Talbot*, will be laid down. The *Phæton*, which is expected home from the Mediterranean, and the *Warspite*, from the Pacific, will come to Devonport to be paid off and refitted, and the battleships *Temeraire* and *Northumberland* are also in hand. Before the end of the year, one if not two ships are expected from Pembroke, where the *Renown*, *Cambrian*, *Flora* and *Hazard* are in process of construction.

The "Hood" and the "Ajax."

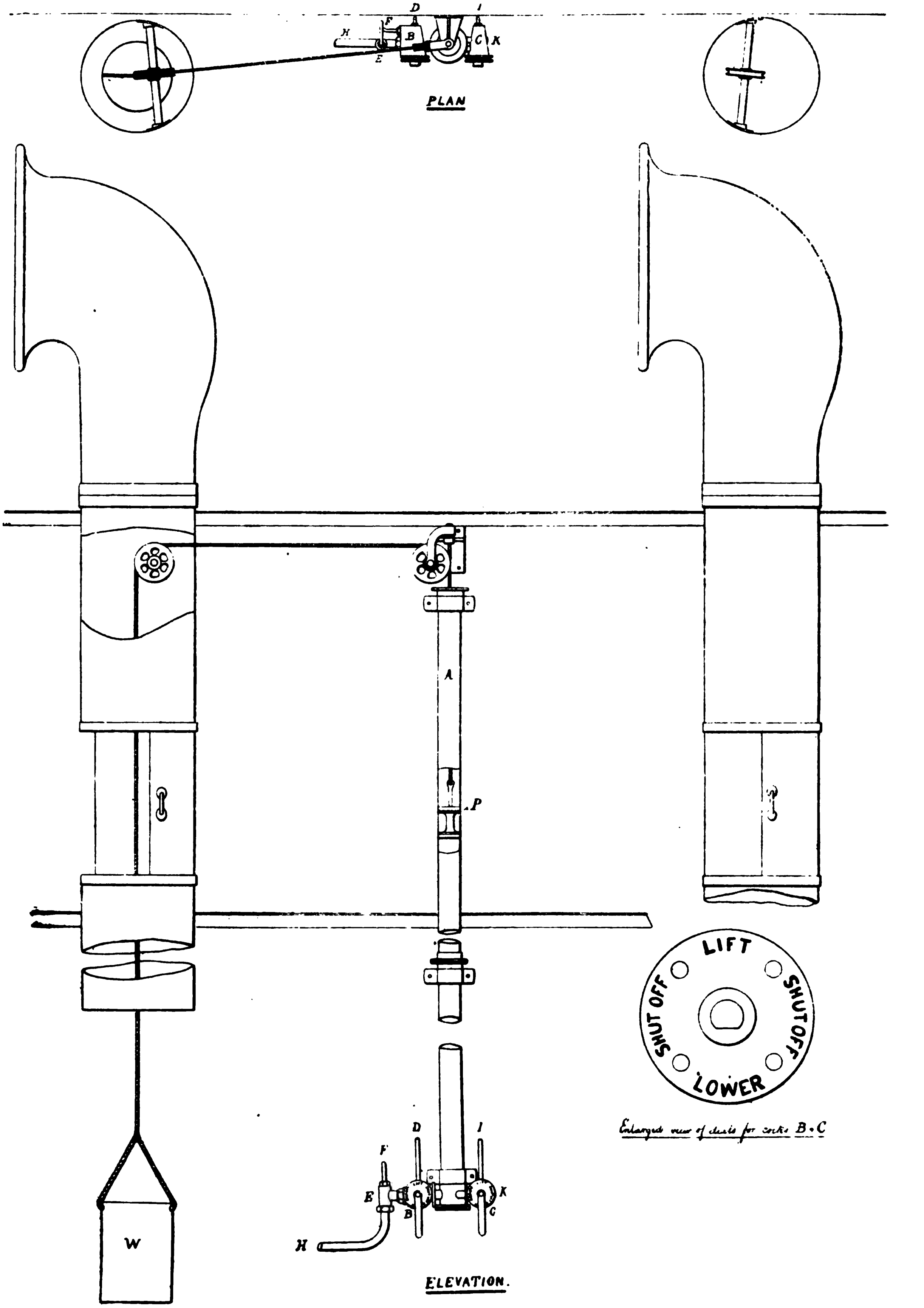
The completion of the *Hood* at Chatham in less than two years is a very creditable undertaking. The *Hood*, which is the largest turret-ship in the world, is therefore one of the quickest built and finished ships of the Naval Defence Act. She is the fastest ship of her class afloat, and besides her propelling engines, which are supplied with steam from eight single-ended boilers, having in all 32 furnaces, there are 69 auxiliary engines, including steering engines, dynamos and electric light engines, air-compressing engines, distilling engines, evaporating engines, and boat-hoisting engines. She carries four 67-ton guns, mounted in pairs in her turrets, and, in addition, ten six-inch guns, double banked, four on the main deck in casemates, and six on the upper deck on sponsons; ten six-pounder and nine three-pounder quick-firers, eight small machine guns, and two nine-pounder field guns. The auxiliary armament is distributed all over the ship, and extends from bow to stern. She also carries seven torpedo tubes, of which two are submerged. This vessel has made satisfactory trials, and has been commissioned for service in the Mediterranean, with 700 officers and men, to relieve the *Colossus*, ordered home. Another addition that has been made to the effective strength of the Navy by her completion for active service is the turret-ship *Ajax*, which has just undergone extensive alterations and repair at a cost of £40,000. She has been fitted with steel roller plates for her turrets, like the *Agamemnon* was, and has had her armament increased by four quick-firing guns on the upper deck, and machine guns in her tops,

Sheerness Dockyard.

Three ships are ready here to pass into the Medway Reserve, the *Brilliant*, cruiser, and the *Jason* and *Circe*, gunboats—all of which have made satisfactory trials of machinery. The *Alarm*, another gunboat, is nearly ready, and the *Onyx*, a similar vessel, is expected from Messrs. Laird's, of Birkenhead, during May. The *Wye*, special service steamer, which has been undergoing an extensive refit at a cost of over £2,000, including the fitting of new shafting, is to sail May 6th, for the West Coast of Africa and Ascension, taking out a new crew for the gunboat *Magpie*. The *Tourmaline*, which came home from the West Indies to recommission, having been here more than a month, was despatched, April 25th, to Bermuda. It is marvellous that such an obsolete and comparatively inefficient vessel shou be still employed when nearly all her sisters have gone to th ship-breakers. The new gunnery school is now in full working, and the *Thunderer* having relieved the *Northampton* as port-guard ship, while the *Benbow* is to act as drill ship for the training establishments—Sheerness is increasing in importance.

Docking the "Howe."

Success has attended the salvage operations of this battleship, and at 2 p.m. on March 30th, the vessel was floated safely off the rocks and anchored in the harbour. Telegrams of congratulation were received by the successful salvors from all the influential bodies who were interested and were fully deserved for Captain Edlin, of the Neptun Salvage Co., and his staff deserve every praise for their assiduity and perseverance in the face of enormous difficulties. The vessel has now been docked, and a thorough inspection has revealed no injury that cannot be temporarily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patched so as to allow the ship to be brought to Chatham for complete repair. The *Howe* has sustained much less injury than the *Sultan*, and will probably be fit for sea almost as soon as the latter vessel, if energetically taken in hand. Her engines and machinery are reported to be fit for use, and in a private letter the writer says that it is anticipated by experts that a twelvemonth will be sufficient to put everything to rights again.

THE LOUDON-SHEPHERD ATMOSPHERIC HOIST.

VARIOUS mechanical methods have been devised for lifting ashes out of the stokeholds of steamers. The most generally adopted are steam-engines of the winch type. These, however, are noisy, expensive and liable to get out of order, and require continual expenditure of stores to keep them in good condition.

The system we illustrate in the present number has been designed to obviate the objections and effect the desired end in the most simple and *absolutely silent* manner possible. The plan of operating the hoist by means of the vacuum produced by the air pump in the condenser is the subject of the patent granted to Mr. Thomas Loudon, Marine Engineer, Glasgow. By that arrangement, however, no means of using the hoist are available when the engines are stopped, or the ship is in port.

The apparatus as now produced is from the designs of Mr. G. B. Shepherd, Consulting Engineer, 34, Leadenhall Street, London, whereby these inconveniences and difficulties are overcome by the application of the well-known principle of the lateral action of fluids.

An ejector E, is connected with the hoist tube A, as shown, which may be actuated either by steam, water, or air under pressure, by which a sufficient amount of air is exhausted from the tube A, to enable the pressure of the atmosphere on the area of the piston P, to lift the weight W to any desired height, the area of the piston being governed by the weight to be lifted.

By means of the compound cocks B and C, either the ejector or the condenser of the main engines can be put into communication with the hoist cylinder A by a single movement of either one or other of the cocks B and C (B being the ejector cock and C the condenser cock) so that when the handle stands opposite the word "Lift," on the dial, the weight W or loaded bucket of ashes on stokehold plates will immediately and silently ascend up the ventilator, due to the fact of the air being exhausted from the tube by the ejector or the condenser, and thus forming a vacuum. The atmosphere forcing down the piston P to which is connected a wire rope direct from piston to bucket or weight, and which can be arranged so that any number of ventilators may be brought into play with one machine, so long as these are worked singly, although it is advisable that each stokehold should have one machine to work either port or starboard as required.

The pipe D is the steam pipe from the boiler to the compound cock, and F is the steam pipe from the cock to the ejector, while H is the exhaust from ejector, and I the main connection between the cock and ejector, K is the opening to the atmosphere on the compound cock C, which is connected to the condenser.

The extreme simplicity of action in this atmospheric hoist, should, we think, commend itself to engineers, shipowners, and users of steam power, as it can be utilized for almost every description of hoisting, loading, and discharging, or even coaling of ships, as it overcomes a great difficulty hitherto not met by other machines that have from time to time been devised to meet the exigencies of a quick and silent means of getting rid of the large accumulations of ashes in the stokeholds of steamers, especially in stormy weather.

We understand that with a machine having a tube 4½ in. diam., a deadweight of 140 lbs. can be lifted with the greatest ease to a height of 30 ft. in 10 seconds, the steam pressure of the boiler being only 60 lbs., therefore when the vessel is in port and there is no steam on the main boilers, the donkey boiler steam can be used instead; in either case the amount required to operate the lift is infinitely small, not actually amounting to half a pound of water per lift, which is returned to the boilers in usual manner. When at sea the condenser vacuum is used, therefore the loss of steam or water from main boilers is nil. It is found that at any position the piston P can be brought to a complete standstill and remain so, therefore no rattling of chains or ropes is experienced when not in use, it is likewise impossible for the firemen to overlift the bucket, as the piston in its descent to the bottom, owing to its peculiar construction, forms an air cushion, and is thus brought to rest quietly without shock or jar, and held there until released by the cock handle being placed at the "lower" mark on disc, therefore it is not within the power of negligent firemen to damage it or bring about accidents from sheer wilfulness, neither is the machine subservient to any automatic catch or cut-off gear, but is what the designer claims for it, a quick, silent, and simple atmospheric hoist; the cocks can be placed either in the lower stokehold or upon the fiddley grating, level with the deck, from which the ashes are put overboard, thus placing the sight of the discs under the immediate control of those operating the hoist.

It is a well-known fact that the hoisting of ashes by hand, more particularly within the tropics, is one of the most trying portions of a stoker's duty, the men going down on watch already exhausted, and in that state commence cleaning fires. This cannot be done as satisfactorily as if the men were perfectly fresh, the consequence is that they take much longer to perform the operation and thus steam and revolutions are lost, which rarely if ever are recovered during the remainder of the watch. Many large boats are not not yet fitted with any mechanical means for hoisting ashes, chiefly owing to the want of some cheap and reliable machine which will not be continually requiring repairs. There is very little doubt that in many cases the adoption of some such machine as this would enable the owners to dispense with the services of at least one man.

We understand that the apparatus has been fitted on board several steamers, the results giving the greatest satisfaction. The machine can be seen in daily operation by applying to the patentee, Mr. G. B. Shepherd, 34, Leadenhall Street, London, E.C.

[illegible] ENGINEER APPOINTMENTS.

[illegible] have been made at the Admiralty [illegible] April [illegible], 1893:—

[illegible] engineer, has been advanced to the [illegible] engineer in H.M. fleet.

[illegible] engineer to the *Trafalgar*, undated.

[illegible] (probationary), assistant engineer to the *Trafalgar*, [illegible] April [illegible].

[illegible] engineer to the *Redbreast*, to date March [illegible].

[illegible] engineer to the *Camperdown*, to date April [illegible].

[illegible] engineer to the *Garnet*, to date April [illegible].

[illegible] (probationary), assistant engineer to the [illegible] March 23rd.

[illegible] engineer to the *Shannon*, to date April [illegible].

[illegible] fleet engineer to the *Benbow*, to date March [illegible].

[illegible] (probationary), assistant engineer to the [illegible] March 30th.

[illegible] engineer to the *Trafalgar*, undated.

[illegible] staff engineer to the *Monarch*, to date April [illegible].

[illegible] assistant engineer, has been promoted to [illegible] engineer in H. M. fleet.

[illegible] engineer to the *Magpie*, to date April 25th.

[illegible] engineer to the *Trafalgar*, undated.

[illegible] fleet engineer to the *Trafalgar*, to date April [illegible].

[illegible] assistant engineer to the *Camperdown*, to date [illegible].

[illegible] (probationary), assistant engineer to the *Trafalgar*, undated.

[illegible] staff engineer to the *Tourmaline*, to date March [illegible].

[illegible] assistant engineer to the *Garnet*, to date April [illegible].

[illegible] assistant engineer to the *Pembroke*, additional, [illegible].

[illegible] engineer to the *Alexandra*, additional, to date [illegible].

[illegible] staff engineer to the *Achilles*, undated.

[illegible] chief engineer to the *Sphinx*, to date March [illegible].

[illegible] chief engineer to the *Barham*, to date May [illegible].

[illegible] assistant engineer to the *Tourmaline*, to date [illegible].

[illegible] engineer to the *Achilles*, undated.

[illegible] to the *Victory*, additional, to date March [illegible].

[illegible] engineer to the *Hood*, to date April 14th.

[illegible] engineer to the *Swallow*, additional, to date [illegible].

[illegible] staff engineer, has been advanced to the [illegible] in H.M. fleet.

[illegible] assistant engineer, to be engineer.

[illegible] engineer to the *Agincourt*, to date April [illegible].

[illegible] engineer to the *Barham*, to date May 2nd.

[illegible] engineer to the *Blenheim*, to date March [illegible].

[illegible] engineer to the *Crescent*, additional, to date [illegible].

[illegible] chief engineer to the *Galatea*, to date April [illegible].

[illegible] fleet engineer to the *Penelope*, additional, [illegible].

[illegible] engineer to the *Hood*, to date March 30th.

[illegible] and New Orleans.—The Southern Pacific Railroad [illegible] arrangements for running a line of steam[illegible] between Liverpool and New Orleans. The [illegible] two 10,000-ton steamers to be bu[illegible]

HOAR & BROWN'S HARDWOOD MARKET REPORT, 22nd APRIL, 1893.

TEAK—	TIMBER. Loads.		PLANKS. Loads.		BLOCKS. Loads.		TOTAL. Loads.
Stock, 1st April, 1893	9,344	..	2,934	..	7	..	12,285
Landings	1,237	..	170	..	15	..	1,422
	10,581	..	3,104	..	22	..	13,707
Deliveries	743	..	140	..	0	..	883
Stock, 21st April, 1893	9,838	..	2,964	..	22	..	12,824

With the exception of the Admiralty orders, there appears to be little business doing in the log trade, and prices remain unaltered, the present stock being quite enough for requirements. The quantity of available timber afloat is very limited. A cargo has recently been placed with one of the large shipbuilding firms. A disturbing feature is the quantity of planks imported lately, the stock being roughly 3,000 loads. It is well known that planks are being taken up among new branches of the trade, and the low values further help to stimulate consumption. The low freights now ruling have induced shippers to send parcels forward, but notwithstanding this, the prices quoted must leave them a loss, and this fact will check further shipments.

MAHOGANY.—The minimum price of 3d. per foot super still prevails, and owners are striving to maintain the position, which if judiciously handled may be carried out to the advantage of all concerned.

There is sufficient stock on hand, and arriving, to last out the summer months, and while trade is dull some cheap sales are likely to be made. Already clearances of stock have taken place in some quarters, and the prices which have transpired must show a serious loss to the owners.

The principal features now offered are Honduras cargoes, and prime quality timber is knocked down at auction at greatly reduced prices for 16 to 20 inch.

There are two fresh cargoes of Cuba, and prices for this class may improve again.

CEDAR PARAGUAY has mostly been cleared off leaving the market now almost bare of stock, with the exception of a small arrival of Cuba, and prices are inclined to advance. A good parcel of straight wood, medium sizes, would command attention.

AMERICAN WALNUT.—The log trade is very quiet, and importations are increasing, which will, no doubt, bring prices down to the old without-reserve figure. Good planks and boards of first quality sell well, and a considerable trade is being done in second class shipments.

WHITEWOOD LOGS.—Some sales have been effected, but at low prices, and the outlook for this article is decidedly bad. Imported boards are very scarce, and prices prohibitive, and while this continues manufacturers will have to turn to other woods for a substitute.

SEQUOIA.—Enquiries are frequent, and some sales are being made, but at low figures. Present quotations should force this wood into consumption, considering the scarcity of the better qualities of pine.

KAWRIE PINE.—Stock is greatly required, and if the market is properly fed, some remunerative business may transpire. There are two parcels expected very shortly.

GREENHEART.—A further cargo has arrived, but the demand being limited, we do not anticipate for it a very ready sale.

PADOUK.—Sales to the United States are large and frequent, but the London market does not appear to fully appreciate the value of this fine timber. Consequently it makes slow progress but several manufacturing firms are now realizing the fact of its superior colour, brightness, and quality, and are making an attempt to draw public attention to it.

Steam Cutters.—A few weeks since the Lords of the Admiralty contracted with Messrs. Waterman Brothers, of Plymouth, for ten 32-ft. steam cutters, to have a speed of 8 knots per hour. During the past fortnight six of these boats have had their steam trials carried out under the direction of Mr. C. M. Johnson, chief [illegible]or of machinery, with satisfactory results. The engines, [illegible]ve been supplied by Messrs. Mumford, of Colchester, [illegible]-condensing. The furnaces are fitted with forced-[illegible]paratus.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(From our own Correspondent.)

One of the earliest things to chronicle this month was the securing by Messrs. Alex. Stephen & Son, Linthouse, Govan, of the contract to supply a large first-class steamer for Mr. Wm. Thomson, Leith, to form one of that gentleman's Ben line of steamers engaged in the Eastern trade. About the same time the Edinburgh and London Shipping Co. commissioned Messrs. W. B. Thomson & Co., Limited, Dundee, to build a steel screw steamer for their Leith and London trade. The new vessel will be fitted by her builders with powerful triple-expansion engines, and all the latest improvements for a first-class passenger traffic, and she is expected to hold the record passage to London on the east coast. Mr. D. M. Cumming, Blackhill Dock, who is now getting a big reputation for small craft, has contracted with the Inverary Town Council for a 65-foot paddle steamer for service between that town and St. Catherine's. At Port-Glasgow Messrs. Murdoch & Murray have contracted to build a 150-foot coasting steamer for Messrs. R. B. Ballantyne & Co., Glasgow, the engines being supplied by Messrs. Muir & Houston, of Glasgow. At the same port Messrs. A. Rodger & Co. have secured the order from Mr. Hogarth, of Glasgow and Ardrossan, to build two fine steel sailing ships of 3,000 tons carrying capacity each.

Greenock is once more indebted to the Messrs. Caird for securing the contract for a large passenger steamer for the Peninsular and Oriental Steam Packet Co. The new steamer, which is for the Australian service, will be of over 7,000 tons and of great speed. While at Greenock we may mention that Messrs. Scott & Co., of that port, have contracted to build a paddle-steamer 145 ft. in length, and with engines of 350 H.P. for a French firm. From the foregoing list of contracts it will be seen that, as predicted in our Notes, the drop in tonnage outputs will be at least more gradual than that experienced after the boom in 1883.

Of course a great deal of attention, not only in engineering circles here, but all over the kingdom, has been bestowed on the trials of the coming greyhound of the Atlantic Ferry, but up to the time of writing no reliable information has come to hand regarding the H.P. developed or speed obtained. On the 13th inst. most exhaustive trials, under the care of the Fairfield Co.'s experts, were conducted, the engines never being stopped for a moment during a continuous run of eight hours. What may be called the fashionable trial took place on the 15th, but it was evidently the aim of those at the head of affairs to abstain from assisting the White Star Line by any data, and to let the actual runs on the ferry stand for themselves. A very interesting trial took place on the 15th, in which the advantages of oil instead of coal as a fuel for passenger steamers was tested. The vessel experimented on was the Caledonian Steam Packet Co.'s steamer *Caledonia*, and though the fittings on board are only of a tentative order, it is expected that a revolution will take place which will dispense with that most unwelcome and dirty task, the bunkering of such steamers. The arrangements have been carried out under the superintendence of Captain James Williamson, and it is understood that general satisfaction was expressed by all concerned regarding the working of the new fuel.

In every Scotch port the shipment of minerals for the year up to date, shows a distinct decrease, the aggregate shipments from the principal ports for the present year being 327,351 tons, as compared with 381,920 for the same period last year—a net decrease of 54,569 tons. The pig-iron warrant market during the month has been very quiet, and prices have remained practically unchanged. A slight fall in prices occurred in Clevelands, whilst hematite, after falling, firmed again. Scotch remains the same, with a slight tendency to drop. In the Clyde Foreign Shipping Trade quarterly report a very considerable falling off has occurred both in the arrivals and departures, but considering the tonnage laid up this was only to be expected. During the first quarter of 1892, locomotive engines to the value of £31,750 were shipped to the Cape, whilst not a single engine has been sent during the past quarter.

The following table of exports from the Clyde will give an idea of the rise and fall which has occurred in the various articles during the past four years.

VALUE IN £ OF PRINCIPAL EXPORTS DURING

	Quarter ending Mar., '93. £	Quarter ending Mar., '92. £	Quarter ending Mar., '91. £	Quarter ending Mar., '90. £
Cotton	1,056,942	1,133,805	1,050,776	1,167,589
Linen	335,185	260,860	252,559	212,831
Steel................	127,559	135,152	118,591	81,298
Iron	300,260	269,679	351,376	432,555
Machinery	181,924	133,677	88,337	105,282
Sewing machines	71,811	130,830	83,594	37,230
Locomotives	81,089	47,508	94,385	99,469

Messrs. Blackwood & Gordon, shipbuilders, engineers and boiler 'makers, Port-Glasgow, are putting down a slip beyond their present tidal basin at the east side of their yard, for the hauling up of vessels. They have acquired two acres of ground immediately adjoining their present property, so that the whole premises will be within one enclosure. On the slip, when complete, they will be able to lift a weight of 1,500 tons, the vessel having a draught of about 10 ft. forward and 14 ft. aft. The length of slip will be about 660 ft. As the slip will be close alongside Messrs. Blackwood & Gordon's engine shop and all the appliances of their yard, it will give very special facilities for the rapid and economical execution of repairs. The approach will be by the old channel of the river right up to the lower end of the slip, and by it vessels can come up at any state of the tide.

TRADE NOTES FROM THE TYNE, WEAR, TEES, HARTLEPOOLS, &c.

(From our own Correspondent.)

THE TYNE.

Shipbuilding.—As was indicated in these Notes last month, measures to obtain a reduction of wages have been undertaken by the shipbuilders, and so far as regards the platers, rivetters, and other sections engaged in the iron and steel departments, have been brought to a definite conclusion. The reduction of 5 per cent. on piece prices and 1s. per week on time wages cannot be looked upon as a very substantial help to the shipbuilders, but small as it is it will no doubt admit of freer action in negotiating for contracts, and may thus be the means of ameliorating the condition of the unemployed surplus by bringing more work to the district. The joiners, painters, shipwrights, and other sections are now under notice of reduction, and it is probable that in these cases an amount equal to that mentioned above will be conceded. Although it does not appear that there is any general improvement in shipbuilding, the state of the industry, so far as the Tyne is concerned, shows a distinct advance as compared with the condition of affairs a couple of months ago. At that time there were at least five yards on the river that were absolutely bare of work; but now there is no more than two establishments which can be said to come under that unenviable description. The Jarrow yard of the Palmer's Co., which was one of the establishments that had no work on the stocks earlier in the year, has now a berth occupied with the keel for a vessel of the largest class, and it is understood that frame-turning has been commenced. Another establishment which shows a marked contrast between the condition of business now and two months ago is Messrs. Edwards' yard at Howdon, where the construction of a large pontoon is in active progress. Messrs. Hawthorn, Leslie & Co.'s yard is also presenting an appearance of animation which was not to be witnessed a short time ago, and the probability is that a further improvement will take place shortly, as an order of exceptional importance has been secured. Messrs. Wood & Skinner have booked an order for two cargo boats of medium size, and frame-turning will be commenced immediately. The only work in progress at Messrs. Stephenson's yard is the construction of two large gates for the Barry Dock, but it is expected that one of the building berths will soon be occupied with the keel for a vessel. The Low Walker yard of Messrs. Armstrong, Mitchell & Co., was never busier than at this moment, there being no less than a dozen large vessels in progress or in preparation, while in the frame turning department it has been found necessary to resort to night work. Business is equally brisk at Messrs. Wigham, Richardson & Co.'s yard, where the frame-turning department is also kept going night and day. The Tyne Shipbuilding Co. have just commenced

the construction of a large vessel, and at Messrs. Readhead's Yard, Tyne Dock, there are several vessels in preparation or in course of building. Messrs. Rennoldson, South Shields, have four vessels of small dimensions on the stocks. It is stated that an important development of the business of a Shields ship repairing firm is contemplated. We hope to be able to give details in a future issue.

Engineering.—The question of a wages reduction in the engineering trade has been partially settled, the representatives of the Amalgamated Engineers' Society having arranged with the employers for an all-round reduction of 2s. per week. A settlement with the sectional societies has not at the time of writing been effected; but there is reason to expect that a similar arrangement to that made with the members of the Amalgamated Society will be accepted by the other bodies of operatives. Although no great accession of work can be looked for in the engineering shops while shipbuilding remains slack, it is hoped that the reduced quotations which are likely to follow the reduction of wages, will have the effect of bringing some "conversion" contracts into the market, and thus stimulating business at the works. One or two of the leading marine engine works continue to maintain a fair show of activity; but in the majority of cases, extreme slackness is the feature, and in some instances short time is being worked. Messrs. Clark, Chapman & Co. continue to have a good demand for their specialities in engineering, one of the most interesting of which—the Clark-Dowson valveless pump for oil steamers—has recently been fitted in a number of vessels. The capabilities of this pump have just been demonstrated in a remarkable manner by the discharging of 4,300 tons of petroleum oil from the s.s. *Astrakhan*, at the Sunderland South Dock, which work was accomplished in less than four ordinary working days, though the oil had to be raised to a height of 80 ft., and sent horizontally a distance of over 3,000 ft., to the receptacles prepared. The Combination Metallic Packing Co. have a good number of orders for their speciality, which is largely used for the engines of warships, and passenger steamers, and in all cases where superior efficiency is essential. The Ferry Engine Works, Tyne dock, which were erected and fully equipped with modern machinery about a year ago, have not yet been put in operation. The works are most conveniently situated near the entrance of the dock, and would no doubt have been started by now, if general trade had been more prosperous. New premises have been erected in the vicinity of the above-named works by a firm of ship-plumbers and ventilator manufacturers, and the place is now being fitted up with suitable machinery for the carrying on of business. At the Jarrow forge and engineering works, business is pretty active, the excellent arrangements provided in the establishment for carrying on work contributing largely to the maintenance of the prosperity existing. The steel and iron rolling mills at Jarrow are only in partial operation, and the output in both cases is much below the average. The chain and anchor departments at Messrs. Abbot's works, Gateshead, are kept moderately busy, and the anchor shops of Messrs. Spencer & Sons, Newburn, also present an appearance of considerable activity. Mr. George Tyzack, of South Shields, has recently received a good many orders for his well-known patent anchors, from foreign shipowners. Considerable briskness exists at the works of the Holzapfel's Compositions Co., the products manufactured being in good demand notwithstanding the depressed state of the shipping trade. The works of the Zynkara Co. are also kept briskly going, and it is probable that further extensions will have to be made, to enable the company to cope with the steadily growing demand for their speciality. Messrs. Gilham & Co., of 32, Mosley Street, Newcastle, have been appointed local agents for the sale of Lockwood's patent improved "flangeless" piston rings, which are said to possess very special advantages. Messrs. Gilham are also agents for the "Dodge" patent wood split pulleys, introduced by Messrs. Braithwaite & Sons, Kendal, and for several other important engineering specialities. New shearlegs and other accessories to facilitate the execution of contracts, are being fitted up at the Dunston Engine Works.

Electric Lighting.—Messrs. J. H. Holmes & Co. have recently completed an electric lighting installation in the s.s. *Iris*, an oil carrying steamer built by the Palmer's Co. to the order of owners at Antwerp. The installation consists of 75 lights, with coupled plant engine 5½ in. by 5 in. stroke, and dynamo of the *Castle* type, No. 12, 60 volts, 80 ampères, and 350 revolutions, the whole being constructed in accordance with the rules and requirements of Bureau Veritas. In pump-rooms, engine-room, &c., all the wires are lead covered and cased in teak. All portable lamps have interchangeable couplings, so that all the flexible cables in the ship can be coupled in one long length, if required for examining the bottom of tanks and other parts of the vessel. The binnacles, mast, and side lights are all included in the installation. The firm have also completed an installation in the s.s. *Caldy*, built by Messrs. Richardson & Duck, of Stockton, to the order of Messrs. Farrar, Groves & Co., of London. The installation has 85 lights and coupled plant, the engine being 8 ft. by 6 ft., with automatic expansion governor acting directly on the throw of the eccentric. It is fitted with flywheel grooved for six ropes to drive dynamo. The dynamo is No. 12, 65 volts, 150 ampères, and 550 revolutions per minute. It is driven by ropes on the endless rope principle, the rope being led over a jockey pulley fixed to the bulkhead. As previously stated, there are 85 lights throughout the ship, and for Suez Canal requirements a projector and arc lamp are also fitted. The vessel is wired on Messrs. J. H. Holmes & Co.'s improved single wire system, which ensures absolute immunity from compass errors, and is without doubt the most satisfactory method now in use for wiring ships. In many vessels wired on this principle the cost of repairs does not amount to 10s. per year, a fact which is certified by the consulting engineers. Messrs. Holmes & Co. have at present no less than 28 vessels in course of lighting, or to be lighted, among which may be mentioned the s.s. *Aras*, the s.s. *Tees*, the s.s. *Arabistan*, and the s.s. *Potomac*. They are also fitting a magnificent yacht, belonging to Mr. Gordon Bennett, with electric light, electric fans, projectors, &c. It may also be mentioned that the firm completed last month an installation of 200 lights, with search light and electric fans in Mr. Laycock's splendid yacht the *Valhalla*. The firm have just finished the construction of the largest dynamo ever made in the district, and they are, it is understood, prepared to undertake the putting down of electric cranes, winches, and other accessories of a like description.

THE WEAR.

Shipbuilding.—The machinery of the Wear Conciliation Board has again been brought into requisition this month for the adjustment of such differences as have arisen between the sections of operatives represented on the Board, and the employers, in respect of the proposed reduction of wages. These differences only relate to the amount of the reduction, and will no doubt have been satisfactorily arranged by the time these lines are in print. Not the least of the advantages resulting from the existence of such an institution is, that the friendly relations established between the employers and the different sections of men are never endangered, but become stronger with the lapse of time. The yard of Messrs. J. L. Thompson & Sons continues to show a marked contrast, as regards the state of business with many other establishments on the river, all the berths being occupied, and full complements of hands being employed in all departments. Messrs. Blumer & Co. have two vessels on the stocks, and have just booked an order for a medium-sized steamer on account of owners at Tonsberg, Norway. Messrs. R. Thompson & Co. have but one vessel in progress at the Southwick yard, but the s.s. *Wildflower* has been undergoing an extensive overhaul in the firm's graving dock, and for some weeks past this contract has engaged the services of a large number of men. At Mr. Laing's yard there is still a good deal of work in hand, and at Messrs. Doxford's the construction of a vessel of the "turret" type, has just been commenced. It is believed that this type of vessel will prove a success, the results of the first voyage made by the s.s. *Turret* (the first vessel of the type built) having been most satisfactory. The voyage, it should be stated, was made under circumstances which were well calculated to test the qualities of the vessel. Messrs. Short Bros. have sufficient work in hand to keep the machinery fully going; but at the yards of Messrs. Pickersgill, Messrs. Priestman, and Messrs. Osborne & Graham there is very little doing. The new enterprise referred to in last month's notes, which implies the early opening of an establishment for the building of small vessels at Hylton, has now been satisfactorily initiated, and it is probable that the arrangements for commencing work will be completed by midsummer. One of the principals in this undertaking is Mr. George McAndrew, who for many years held the position of shipyard manager under Messrs. Robert Thompson & Sons, and more recently acted in a similar capacity for Messrs. Pickersgill. His experience cannot but be

of the very greatest advantage to the new firm, who will commence business under auspices of the most favourable kind.

Engineering.—Work in the local marine engineering establishments has perceptibly decreased during the past month, and in some cases it has been found necessary to discharge or suspend numbers of the operatives. Some disturbance with regard to the employment of a wood-turner in the pattern shop at the Southwick Engine Works has occurred, resulting in the greater part of the pattern makers turning out on strike. It is understood that they decline to work with the individual in question on the ground that he is not a member of their union. The night shift at the Palmer's Hill Works has been partially discontinued. At the Wearmouth Foundry, Monk Street, there are considerable extensions in progress, but the work now in course of execution is less than for some time past. In the iron works business is still slack, and forges are generally showing a condition of inactivity. Chain and anchor works are only kept in partial operation, and rivet manufacturers have comparatively little to do. Messrs. J. W. Plumb & Co., compass adjusters, &c., Bridge Terrace, though not employed to their fullest capacity, are doing a fairly satisfactory business.

The Hartlepools.—Shipbuilders at this centre continue to receive a fair share of whatever work is to be had, and the yards present, on the whole, a very satisfactory appearance. In spite of the generally prevailing trade depression, the Hartlepool Engine Works are still kept fairly busy, the proprietors, Messrs. Thos. Richardson & Sons, having several important contracts in hand. Among these may be mentioned new engines and boilers for the steamers *Sybil*, *Rimpha*, and *Orpington*, owned by Messrs. R. Gordon & Co., of Newcastle, and the machinery for two large cattle boats, building by Messrs. Furness, Withey & Co., for the Chesapeake & Ohio Railway Co. At the sheerlegs the s.s. *Phœnix*, a new vessel built by Messrs. Raylton Dixon & Co., for Messrs. Hayland & Co., London, has lately received her machinery, and will shortly be ready for sea. This is a similar ship to the s.s. *Pendarves*, which was built and engined by the same two firms during the latter part of 1892, and which the owners (Messrs. R. B. Chelly & Co.) report to be doing excellent work, a speed of nearly 9 knots being maintained on a consumption of 13 tons of coal per day, the deadweight carried being 4,000 tons. Messrs. Richardson have also recently completed several low pressure boilers for old vessels, including the steamers *Nelly Wise* and *Lady Bertha*. The demand for Morison's evaporator is fully maintained, and the department of the works where this speciality is manufactured, is exceptionally busy. In the forging department, a good many orders are being executed for all descriptions of shafts. As an illustration of the quick delivery which Messrs. Richardson can guarantee, the following incident may be cited:—Late on Monday, the 10th April, an order was received by wire from Messrs. Chargeurs Reunis, Havre, for a large thrust shaft. Work was commenced on the order the same night, and the shaft was machined, finished, and delivered at Southampton ready for shipment at 8 a.m. on the 14th April. This is a really remarkable performance, and shows that Messrs. T. Richardson & Sons have exceptional facilities for dealing with work of this description, in regard to which quick despatch is usually of the utmost importance. The proprietors of the Hartlepool Rope Works are making important extensions, and contemplate something of a newer departure in connection with the manufacture of specialities. They are putting down additional plant, including 100 H.P. gas engine by Messrs. Andrews & Co., of Stockport.

Stockton.—At the whole of the Stockton shipyards, business is still in a fairly satisfactory state, but it is doubtful if this description will apply at a later period of the year, as no new orders are reported. The following vessels engined by Messrs. Blair & Co., have had their trials during the past four weeks:—the steamers *Cabo de la Huo* and *Cabo Fortosa*, built by Messrs. J. L. Thompson & Sons, Sunderland, for Messrs. Ybarra & Co., of Seville, having engines with cylinders 18 in., 29½ in., 48½ in., by 33 in. stroke. The s.s. *William Storrs*, built by the Tyne Shipbuilding Co., Willington Quay, for Messrs. Stephens & Mawson, of Newcastle, having engines with cylinders 24 in., 40 in., 65 in., by 42 in. stroke. The s.s. *Lyderhorn*, built by Messrs. Ropner & Son, Stockton-on-Tees, for Captain Troye, of Bergen, having engines 23 in., 37½ in., 61½ in., by 39 in. stroke. The s.s. *Westgate*, built by Messrs. Thomas Turnbull & Son, of Whitby, for Messrs. Turnbull, Scott & Co., of London, having engines 23 in., 37½ in., 61½ in., by 39 in. stroke. The engines for the whole of these vessels were constructed for working at 160 lbs. pressure of steam, and on the trials worked with the greatest smoothness, giving complete satisfaction to all who were interested in the results.

Middlesbro'.—Messrs. Raylton Dixon & Co. have been exceptionally successful in obtaining contracts lately, and all their berths are now occupied. Messrs. Craggs & Co. have a small cargo boat and a number of fishing vessels in progress, and Messrs. Harkess & Sons have two vessels on the stocks, besides a repair contract of some importance. Prices of new steamers are reported to be unprecedentedly low, and builders who desire to book contracts can scarcely do so without incurring the risk of almost certain loss. Steel rolling mills are rather busier than at the opening of the year, but iron works show no improvement

Darlington.—The Darlington Forge Co. have received sufficient orders this year to enable them to keep a large part of their machinery in operation. This satisfactory state of matters is doubtless attributable to the fact that the establishment is provided with the very best facilities for turning out work, and orders can consequently be executed with great promptitude.

Consett.—The new steel angle mill, recently erected in connection with the Consett Iron Company's works, has been started, and the weekly output is already very large.

NORTH-WEST OF ENGLAND.

(*From our own Correspondent.*)

Barrow.—The gloom which overshadows the shipbuilding trade generally, is more and more apparent in the Furness district, and it is evident that much new business will soon be required to keep the local yards in full employ. As work is being gradually finished, and as the orders in the hands of local builders are being completed, their yards and their docks begin to look empty, and there is marked inactivity apparent. Generally speaking, it has been found necessary to dispose of several men in the initial departments of local yards, such as draughtsmen, patternmakers, &c., and unless new orders are soon booked, persons engaged in other departments of trade will have to follow suit. There are, however, some enquiries to hand, and the estimating departments are fairly employed. It is feared, however, there will not be much new tonnage built during the year, and the probability is that shipbuilding in Barrow, as in other parts of the country, will witness a dull time. There is the chance, however, that very low prices may induce many owners to build, in preference to waiting for better times, and there is some reason to believe that advantage will be taken of these depressed times to break up a number of old steamers which can never be used profitably in trade any more. If this is done, and it is the only practical course to adopt, room will be made for new tonnage, and this will be one of the means of rectifying what is at present a very dull trade. During the month, the Naval Construction and Armaments Co. has launched a large troopship for the Indian Government, particulars of which will be found in another column. She will be fitted out for sea in the course of the next six weeks or two months. The same company have delivered to the Admiralty the torpedo cruiser *Niger*, the third and last embraced in the order given to the Barrow yard. The *Niger* has shown, like her two sister ships, the *Jason* and the *Jaseur*, a high-rate of speed—20 knots. It is interesting to note that when the order for six of these gunboats was given out by the Admiralty, three came to Barrow, two went to Laird's, at Birkenhead, and one to Thorneycroft's. The Barrow company have delivered the three with which they were entrusted, but the other builders have not yet completed their contracts. Much progress has been made with the sand dredger which is being equipped at Barrow with powerful pumps and engines, with a view to operations on the Mersey Bar. She will soon be ready for her trials, and they will prove very interesting, because of the immense power and immense capacity of the vessel, and the novel and ingenious means which have here been adopted for raising a large body of sand. The other orders on hand at Barrow are not of importance, but it is expected before another month passes further orders will be booked, as spirited efforts in that direction are being made. In the engineering department there is a scarcity of orders at present, but prospects are very good, as also in the boiler department.

Shipbuilding Material.—There is only a quiet demand for shipbuilding material of all descriptions, and local makers are

still unable to compete for the few orders offering at current prices. They are undersold to the extent of 7s. or 8s. per ton.

West Cumberland.—There is a fair amount of activity at the small shipbuilding yards on the Solway, but there is not much demand for new tonnage. Work proceeds steadily, however, and builders manage to launch and equip their ships for sea, and to sell them easily in sixty-fourths.

THE MERSEY.

(*From our own Correspondent.*)

THE position generally throughout all branches of the marine engineering, shipbuilding, and allied branches of industry in this district continues very unsatisfactory, and there is still no indication of any improvement. On the Mersey, an absence of new work of any importance coming forward, continues to be reported, and marine engineers generally are only very indifferently employed, whilst as to shipbuilding, with perhaps one exception, yards generally are almost bare of work. Messrs. Laird Bros., of Birkenhead, have made rapid progress in finishing the large line of battleship, the *Royal Oak*, which is now nearly ready for her steam trials, and the new Channel steamer, the *City of Belfast*, which has been built for the Barrow Steam Navigation Co. as an addition to their extensive fleet, which conducts the mail and passenger service between Barrow and Belfast, has been completed, and undergone very satisfactory trials. The vessel has been designed as a first-class passenger, cargo, and cattle boat, and is a steel twin-screw steamer, with straight stem, and elliptical stern. She has two steel decks, and an awning deck, running the whole length fore and aft, forming a magnificent passenger promenade. The scantlings have been erected with the object of making the vessel especially strong, and the ship is divided into eight compartments. The dimensions of the vessel are 280 ft. by 32 ft. by 14½ ft., the gross tonnage being 1,065. The first-class passenger accommodation is of a very luxurious character all through, whilst most excellent accommodation is also provided for steerage passengers and cattle dealers. The vessel is expected to be registered to carry about 900 passengers, and sleeping accommodation is provided for 130 first-class, and 50 steerage. For cattle accommodation, excellent provision has been made, and removable pens are provided for 530 beasts, on the main and lower decks. The ventilation of the ship throughout has received special attention, and so far as the cattle are concerned, they can be carried in all weathers, owing to the excellence of the arrangement for the admission of pure air. Stalls for 100 horses have also been provided, and in addition to these, the vessel will, when fully loaded, carry a cargo of 250 tons, with a load draught of 9 ft. 6 in., even keel, this condition being necessary to meet the exigencies of the port of Barrow. Effective trimming arrangements are secured by two large tanks, holding 50 tons each, placed forward and aft, and the after tank will be utilised when in deep water to give greater draught aft. The machinery, which has been specially designed and built by Messrs. Laird Bros., consists of two separate sets of direct-acting triple-expansion engines, the cylinder dimensions being 18 in., 22 in., and 42 in respectively, with a 30 in. stroke. The arrangement of the cylinders is rather peculiar, the tops being inclined towards each other, and this enables the casing to be made narrower and gives a wider passageway on either side. There are two boilers, 15 ft. by 17 ft., worked under forced draught at 160 lbs. pressure, and the contract I.H.P. is 2,500. A steam fan supplies the draught to the stokehold, the pressure being 1 in. of water. There is the usual auxiliary machinery, and the propellers are of manganese bronze. A separate electric lighting plant has been provided to supply 120 sixteen candle-power lights besides a number of cargo clusters to the two holds, and the masthead light and side lights. At the trial, a four hours' run was made, the measured mile being covered several times, and then a speed trial was made between the light-ships. The contract was for 16 knots, with 50 tons of cargo, and at the trial the vessel's mean draught was 8 ft. 8 in., whilst her mean speed for the four hours came to a little over 17 knots. The mean revolutions were 150, the boilers being worked under a moderate air pressure, and the total I.H.P. reached 2,700, the vessel's performance thus being far in advance of what the builders contracted for, while the engines worked steadily and well, and the absence of vibration was particularly noticeable. The manœuvring powers of the vessel were also pretty fully tested, and here the advantage of the duplicate screws was at once made obvious.

The docks of the Manchester Ship Canal at Manchester and Salford have recently been the centre of considerable activity in shipbuilding operations. The completed portions of the docks have been utilised as dry docks, and in these, twelve barges and a couple of steam dredgers have been built. The steam dredgers are each 132 ft. overall in length, 37 ft. overall in breadth, and 10 ft. deep, drawing 7 ft. of water, and weighing 500 tons each. These two dredgers, which have been named the *Irk* and and the *Medlock*, are constructed to lift 500 tons of ordinary material per hour, and are capable of dredging in their own depth of water, or down to 30 ft. below the water level. For the purpose of building these dredgers, 130 men were brought from Scotland by Messrs. Fleming & Ferguson, of Paisley, the builders, and, together with the barges, have now been floated, and are at work in the canal. As to the docks themselves, both those in Manchester and Salford are now practically finished, except so far as some dredging work out of the bottoms is concerned, and the removal of the dams which, in one or two cases, still remain at the entrances. The erection of covered sheds on the canal and quays has commenced, two of these having been placed in the hands of Manchester engineering firms, and the stretch of canal between Manchester and Barton requires very little further work before it is finished.

With regard to general engineering work, there is still no appreciable improvement to report, except that, perhaps, the locomotive building industries are rather better supplied with work than they were recently, but this has had to be taken at excessively low-cut prices. Boiler makers continue to secure a fairly satisfactory weight of orders, although only at low prices, and stationary engine builders are kept generally moderately well employed, one or two of the principal firms having work which will keep them going for some time to come. Machine tool makers, however, are still only very indifferently off for orders, although one or two of the principal firms are kept moderately going. Any new work going out is so keenly competed for that it is scarcely worth having, except to keep shops going. In the general run of engineering there is very little stirring, and most of the firms throughout this district are rather short of work. With regard to employment, the number of out-of-work members on the books of the Trades Union Societies remains about stationary, but, if anything, the tendency is rather to increase than otherwise.

In the iron trade, business all through the month has continued only of a slow, hand-to-mouth character, with a gradual downward tendency in prices, and merchants and dealers are still quoting very low for forward delivery. Lancashire makers of pig-iron, who are practically out of the market, except where they have especially favourable rates of carriage, are not now quoting more than about 41s. to 42s. for forge and foundry qualities at the works, whilst in district brands, Lincolnshire iron is now offering for delivery in this district at about from 40s. 6d. to 41s. for forge, and about 41s. 6d. to 42s. for foundry, less 2½. All the outside brands of pig-iron offering here are also easier, good named foundry Middlesbrough being readily obtainable at about 42s. 6d. to 42s. 10d. net cash, delivered Manchester, whilst Scotch iron can be bought forward at about 44s. for Eglinton, and 46s. for Glengarnock, net, prompt cash, delivered at the Lancashire ports.

For manufactured iron, prices have also given way durngi the month, and Lancashire bars, delivered Liverpool or Manchester, do not average more than £5 10s., with North Staffordshire qualities obtainable at £5 10s. to £5 12s. 6d.; Lancashire sheets about £7 to £7 5s.; and Staffordshire qualities, £7 7s. 6d. to £7 10s.; and Lancashire hoops, quoted at £6 for random, and £6 5s. for special cut lengths.

The steel trade is very quiet in all departments, with raw material gradually easing down in price, good foundry hematites, in small quantities, delivered to engineers in this district, being readily obtainable at about 54s., less 2½, and in larger parcels at substantially under this figure, whilst steel billets, delivered in this district, have been sold at about £4 2s. 6d. to £4 4s. per ton, net cash. The principal makers of steel boiler plates still quote £6 10s. for delivery to consumers in this neighbourhood, but are taking £6 7s. 6d., whilst in shipbuilding plates prices are very irregular.

A moderate amount of business has been coming forward in the metal market, but with the close of the month, there is rather a disposition to hold back, in the expectation that list rates for manufactured goods may have to give way, owing to the recent downward tendency in raw material. So far, however, list rates have undergone no very material change, and for delivery Liverpool or Manchester are quoted as under:—Solid drawn brass boiler tubes, 5¼d.; solid drawn brass surface condenser tubes, 7d.; solid drawn copper tubes, 7¼d.; brazed copper gas and steam tube, 7d.; brazed brass gas tube, 6½d.; brazed brass machine tubes, 6½d.; brass wire, 5½d.; copper wire, 6¾d.; rolled brass, 5½d.; sheet brass, 6¾d.; yellow metal bolts, 5½d.; yellow metal condenser plates, 5½d.; cast composition sheathing nails and

spikes, 5¾d.; cast red metal sheathing nails and spikes, 7½d.; wrought copper rivets, 8½d.; wrought copper boat nails, 8½d. to 9½d.; wrought copper tacks, 11½d. to 1s. 2½d.; cut copper nails, 8d. to 9½d. per lb.; copper bolts, £61 per ton, and strong copper sheets, 57s. per ton.

In the timber trade, imports have recently been small, but in some articles the deliveries have been fair, and in many cases sales have been forced, with the result that values are difficult to maintain, and stocks are generally heavy. Trade all through shows a want of animation, and a great want of confidence with regard to the future. Of East India Teak there has been only a small arrival, and with a moderate consumption stocks have been gradually decreased and prices continue fairly steady. In greenheart there has also been only a limited import, but as the consumption remains almost nominal, stocks continue ample.

In the coal trade there has been a gradually decreasing demand for all descriptions of round coal, and although the output has been restricted, very few collieries working more than three to four days per week, considerable stocks have been accumulating. Not only are the better qualities of round coal difficult to sell, but the lower descriptions for iron making, steam, and general manufacturing purposes, become more and more of a drug, and the market, so far as this description of fuel is concerned, could scarcely be in a worse position. To effect sales, almost any price, from 6s. 6d. per ton at the pit-mouth, upwards, has been taken, and the outlook with regard to the usual contracts which are placed during the summer is causing considerable uneasiness on the part of colliery owners, as there is almost certain to be an exceptionally keen competition, which necessarily means excessively low prices being taken. The necessity of some substantial reduction in wages to meet the very serious fall which has already taken, and is likely to take place, in prices has been brought forward, but colliery proprietors in Lancashire are unable to take any definite action in this direction without the co-operation of Yorkshire, and as some of the principal colliery owners in the above county do not seem disposed to move, the matter at present stands in abeyance, although one or two neighbouring mining districts have expressed their willingness to join in sending out notices for a reduction in wages. The only section of the trade which shows any life is in engine classes of fuel, which, since the resumption of work at the cotton mills, have been in active demand, and with the scarcity of supplies, owing to the restricted quantity of round coal now being screened, prices have shown a decided upward tendency, advances of 3d. to 6d. per ton having been made in a good many cases. Good burgy now averages quite 6s. 6d., best slack, 5s. to 5s. 6d., with common sorts not obtainable under 3s. 9d. to 4s. 3d. per ton at the pit-mouth. Should, however, prices for slack move upwards to any very material extent, it is not unlikely that the excessively low price of common coal will induce buyers to turn on to this, rather than pay what they may regard as an exorbitant figure for engine fuel.

In the shipping trade, business, all through the month, has continued extremely depressed, and there has been an almost complete absence of business of any weight offering; for ordinary steam coal, delivered at the ports on the Mersey, 8s. per ton represents the average current price, but in some cases sellers have been offering at as low as 7s. 6d. per ton to effect clearances of stocks, and even this excessively low figure does not seem to afford any very great temptation to buyers.

HULL AND DISTRICT NOTES.

(From our own Correspondent.)

Hull.—During the last month the port of Hull has been passing through a great struggle between capital and labour. The points at issue are nominally the introduction of free labour into the port, and the establishment of a joint board of arbitration—the dockers complaining of the first, the shipowners refusing the second. But, really, the men are now trying to smash the Shipping Federation, the employers to smash the Union. It is a stand-up fight between capital and labour, a sad spectacle from whatever situation it may be viewed. Capital is expected to win, the Docker's Union not being in funds, and having to rely on outside assistance for continuance of the struggle, principally against the largest private firm of shipowners in the world, who have long enjoyed almost a complete monopoly of the oversea carrying trade of this port. Some shipowners have removed their vessels to other ports; others, less fortunate, who have retired from business, or from whom business has retired, now find both their former ships and trade swallowed up by this wealthy firm.

The action of the authorities responsible for the peace of the borough in importing military into the town and augmenting the police from other places, has been contrasted by the Chairman of the Watch Committee with the refusal of the employers to meet the men, or to submit the matters in dispute to arbitration, or even to listen to any conciliatory proposals through the Mayor, at the request of the Magistrates and Town Council, with a view to terminate the dispute. Perhaps it was thought, in such a dispute, the Mayor might act better as an arbitrator, than an assembly of *local* men as a sort of conciliation board—to obtain the advantage of their joint wisdom you inevitably assemble with these men all their prejudices, their passions, their errors of opinion, their local interests, and their selfish views. Such an assembly, might be thought, could scarcely be expected to take a calm, judicial view of the matters in dispute. Moreover, the shipowners are not locally controlled, any more than the dockers; both are members of separate unions, called *national*, whose headquarters are in London, who have instructed the members who live in Hull to abide *firmly* by the decisions of their respective leaders. Unfortunately the peaceful overtures of the Mayor did not prevail, and up to the time of writing these Notes it is a matter for universal regret that the negotiations which were opened up between the contending parties in the present crisis, through the powerful intervention of the President of the Board of Trade, in his private room at the House of Commons, have also as yet had no fruitful result, especially when the ground of dispute has been reduced to such narrow limits that if both parties would show a conciliatory spirit a settlement might easily be effected—satisfactory and honourable alike to both employers and men.

We might here mention that there are about 185 foreign-going steamers owned by Hull shipowners. Of these 115 steamers are owned by Messrs. Thomas Wilson, Sons & Co., and Messrs. Bailey & Leetham. Of the remaining 70 steamers about 50 are "tramps," and the other 20 are running in lines. During the year 6,000 vessels (of 2,750,000 tons) arrive in Hull from abroad and coastwise; of this number, over 1,000 (of about 800,000 tons) are owned by the Wilson firm, and 250 (of some 200,000 tons) are vessels belonging to the Bailey fleet. Thus more than one-third of the tonnage which comes into Hull is supplied by the fleets of Messrs. Wilson, and Bailey & Leetham, whilst these firms supply a fifth of the vessels. (In the above calculations each *arrival* of a vessel counts as a vessel.)

A great deal of the shipping trade has left the port during the last month, and may possibly not return. What is the misfortune to Hull may be a matter of congratulation for the competing ports of Grimsby and Goole, who are already rapidly feeling the benefits of our disturbed conditions; and the Shipping Federation, being composed of traders from all over the country, are apt to forget, or to look with indifference upon the effects of this strike in Hull.

H.M.S. *Endymion*, which has been built and engined by Earle's Shipbuilding and Engineering Co., left the Alexandra dock on the morning of 7th April, and made a very satisfactory run round to Portsmouth, H.R.H. the Duke of Connaught and the Port Admiral, Earl of Clanwilliam, inspected the vessel on arrival, which came in for special praise as being the best finished contract-built ship that had been delivered at that Royal dockyard under the Naval Defence Act, 1889, when 70 war vessels were ordered to be built, of 319,480 total tonnage, costing £21,500,000, 38 of which were ordered to be built in the royal dockyards, and 32 by contract.

H.M.S. *St. George*, another sheathed first-class protected cruiser, built and engined by Earle's Co., is gradually advancing towards completion, and the engines, &c., for H.M.S. *Charybdis* are now ready for fitting on board after the launch of that vessel from Sheerness dockyard, about the middle of this month.

The Great Eastern Railway Co.'s twin-screw passenger steamer *Chelmsford*, also built and engined by Earle's Co., has gone through a very interesting series of progressive trials on the measured mile off Withernsea, and her official deep sea trials have given entire satisfaction to all concerned.

ONE of the leading officials connected with the Chief Constructor's staff at Chatham Dockyard has, by direction of the Admiralty, proceeded to Ferrol, there to make a thorough survey of the *Howe* and report on the nature of the injuries which the vessel has received.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Beaumont.—On March 22nd there was launched by Mr. W. H. Shilston, at Plymouth, a schooner of 128 tons register, built to class A1 14 years at Lloyd's, and named the *Beaumont*. She is intended for the Newfoundland and general foreign trade.

Creole Prince.—On March 29th Messrs. Short Brothers launched at Sunderland, a steel screw steamer built to the order of Mr. James Knott, of the Prince line of steamers, Newcastle-on-Tyne. The vessel is constructed of Siemens-Martin steel throughout to the highest class on the spar-deck principle in Lloyd's Registry, and is of the following dimensions, &c.:—Length, 290 ft.; breadth, 37 ft.; depth, 25 ft. The vessel was named *Creole Prince*, and is to be engined by Messrs. Blair & Co., Limited, of Stockton.

Aras.—On March 30th there was launched by Palmer's Shipbuilding & Iron Co. at Howdon-on-Tyne shipyard, a large screw-steamer of the following dimensions:—Length, between perpendiculars, 325 ft.; breadth, 42 ft. 6 in.; depth, moulded, 29 ft. 9 in. Her carrying capacity is about 3,400 tons gross. The vessel is built to Lloyd's highest class, and is, specially constructed for carrying petroleum in bulk. The machinery is placed aft, and a poop is fitted extending to the fore end of the machinery space. Accommodation for the captain and officers is provided in a short bridge-house amidships, and the crew will be berthed in the topgallant forecastle. The oil will be carried in 14 separate compartments, and all the latest improvements are fitted for the filling and discharging of the oil. The vessel is lighted throughout with electric light. The christening ceremony was performed by Mrs. Glover, wife of the Newcastle agent for Messrs. Bessler, Waechter & Co., London, the owners.

Screw Steam Hopper.—On Saturday, April 1st, Sir Raylton Dixon & Co. launched from their Cleveland Dockyard, Middlesbrough, a screw steam hopper of special design for the London and South Western Railway Co., for use in connection with the improvements of docks, &c., at Southampton. This vessel, being very urgently needed, has been rapidly built, and she has a hopper capacity of over 500 tons of dredged materials. Special winches have been fitted for working the hopper doors, and many improvements have been embodied in the construction of the vessel which will enable her to deal successfully with the work for which she has been designed, which has been made a speciality of her builders. Her dimensions are:—Length, 152 ft. 6 in.; beam, 25 ft. 1 in.; depth, 10 ft.; and she has been constructed under the supervision of Mr. John Dixon, dock superintendent, Southampton. Engines will be fitted by Messrs. Westgarth, English, & Co., of Middlesbrough.

Embiricos.—On Wednesday, April 5th, there was launched from the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesbrough, a steel screw steamer of the partial awning deck type, with poop and raised quarter-deck, which has been built to the order of A. Embiricos, Esq., of Braila, under the superintendence of Messrs. William Esplen & Son, of Liverpool. Her principal dimensions are:—Length, 313 ft.; beam, 41 ft. 2 in.; depth, moulded, 21 ft.; and she has a deadweight carrying capacity of over 3,500 tons. The greater portion of the exposed decks are of chequered iron, the remainder being steel, sheathed with wood. Water ballast is provided for under the machinery space and at the ends of the vessel, also in deep tank amidships. A very complete outfit of steam machines will be supplied for working cargo, for steering, for working the anchors, &c. Engines will be fitted by Mr. John Dickinson, of Sunderland, the cylinders being 23 in., 37 in., and 60 in., by 42 in. stroke, with large boilers, working at a pressure of 160 lbs. As the steamer was leaving the ways, she was named the *Embiricos* by Miss Boolas.

Hong-Kong.—On Wednesday, April 5th, there was launched from the yard of the Sunderland Shipbuilding Co., Limited, a steel screw steamer, built to the order of Messrs. Marty & d'Abbadie, of Haip-Hong, being the second vessel constructed by the above firm for these gentlemen, and is specially intended for the Haip-Hong and Hong-Kong passenger and mail service under the French Flag. The dimensions of the steamer are as follows:—Length between perpendiculars, 240 ft.; breadth of beam, 32 ft.; depth, moulded, 19½ ft.; classed first-class; French Veritas and English Board of Trade; spar deck grade; all decks throughout are of teak. The cabins are arranged specially for hot climates, and are well protected by double awnings from the sun. The crew's quarters are on the main deck forward, also compradors, specie, and mail rooms. The engineers' and officers' berths and mess-room are all in a large teak house aft, and are entirely fitted up in hard-wood. The first-class passenger berths are in a large teak deck-house forward, with shade deck carried out to ship's side, and which is fitted out in polished oak, patent w.c.'s, bath-rooms, with tiled floor, &c. The dining saloon is in another teak house on top of the last mentioned one, and is entirely fitted in polished oak of various shades, and carved oak caps and pilasters, slightly relieved with gold. The ship will be lighted throughout with electricity, which work is being done by Messrs. C. A. Parsons & Co., of Newcastle-on-Tyne. The friction winches and steam steering gear are by Messrs. Clarke, Chapman & Co., of Gateshead, and the steam windlass by Messrs. Emerson, Walker & Thompson Bros., of Gateshead. The compound engines will be supplied by the North Eastern Marine Engineering Co., Ld., of Sunderland, having cylinders 20 in., 34 in., and 56 in., by 39 in. stroke, with two large boilers working at a pressure of 160 lbs., which will give the vessel an average speed of twelve knots laden. During construction the vessel and her engines have been superintended by Monsieur A. Krafft on behalf of the owners. Upon leaving the ways she was gracefully named *Hong-Kong* by Mrs. E. R. Kirkley, of Sunderland, and was then taken to the south dock for her machinery and outfit.

Holmside.—On April 6th Messrs. Wood, Skinner & Co. launched from their shipbuilding-yard at Bill Quay-on-Tyne, a fine steel screw-steamer of the following dimensions, viz.:—Length, 214 ft.; beam, 30 ft.; depth, moulded, 16 ft.; with a deadweight carrying capacity of about 1,300 tons. The vessel has been built to the order of Messrs. William Swanston & Sons, Quayside, Newcastle-on-Tyne, and will be registered in the highest class at Lloyd's, under whose special survey she has been constructed, while Messrs. William Menzies & Co., of Newcastle, have superintended in the interest of the owners. The ship is of the raised quarter-deck type, with accommodation for captain and officers in bridge amidships, the crew being berthed in the topgallant forecastle. She has water ballast in the cellular double bottom all fore and aft, and also in the fore and aft peaks. The vessel is specially designed for the coal trade, having extra large hatches to obviate the necessity for trimming, and she will be fitted with all the latest appliances considered requisite in the equipment of a boat of this description. Her engines are of the triple-expansion type, and have been built by the North-Eastern Marine Engineering Co. (Limited), at Wallsend-on-Tyne. They have cylinders 17 in., 28 in., and 46 in. diameter, with a piston stroke of 30 in., and are supplied with steam by a large steel boiler working at a pressure of 160 lbs. per square inch. The christening ceremony was performed by Miss Ethel Taylor, of Bill Quay, who named the steamer *Holmside*.

Lymington.—On April 6th, Messrs. Day, Summers & Co., of Northam Iron Works, Southampton, launched the steel paddle steamer *Lymington*, which they have built to the order of the London and South Western Railway Co. The vessel is intended to run between Lymington and Yarmouth in connection with the train service. The vessel, which was designed by the firm, is 120 ft. in length between perpendiculars, has a breadth, moulded, of 18 ft., and a depth, from the top of the keel to the underside of deck, of 8¼ ft. She will have a draught of 5 ft., and the specification is for a speed of 11 knots. The engines are of the compound oscillating type. The cylinders are 24 in. and 40 in. respectively, giving a 36 in. stroke.

Elax.—On April 17th Messrs. Wm. Gray & Co., Limited, launched the splendid steel screw-steamer *Elax*, the fourth of the steamers they are building for Messrs. Samuel & Co., of 31, Houndsditch, London, for the bulk petroleum trade to the East through the Suez Canal. The *Elax* is of larger dimensions than the former vessels which have been engaged successfully in carrying oil out to the East, and general cargo home. She will take Lloyd's highest class, and is built on awning or shade deck type. Her dimensions are as follows:—Length, overall, 358 ft.; breadth, extreme, 45 ft. 6 in.; depth, 28 ft. 6 in. The engine and boiler rooms are in the after part of the vessel, and underneath them there is a double bottom for water ballast. The forward and after peaks are also fitted for water ballast for trimming purposes. Forward of the boiler room there are nine strong transverse bulkheads, and also a very strong fore and aft bulkhead from the keel to the main decks. Altogether

there are thirteen separate oil tanks. These oil tanks are separated from the boiler room and bunkers aft, and from the cargo hold forward by large coffer-dams, which are carried to the topmost deck in each case, and which can be filled with water when required, and they are under the control of special and separate pumps placed on deck. Expansion trunks are carried up from the middle of each oil compartment to allow the oil to rise and fall with varying temperatures. These trunks in conjunction with large hatchways will be used for loading general cargoes. Two powerful pumps are fitted in the pump room amidships for discharging the oil cargo. They are capable of pumping out the entire cargo of 4,900 tons of oil in 12 hours, and will also pump water from the sea to fill the oil tanks when required for ballast. When the oil cargo has been discharged, the tanks will be cleansed and adapted to receive general cargo by special means provided. A powerful fan will be fitted capable of exhausting the air from each tank in ten minutes in order to thoroughly ventilate the compartments when filled with general cargo, the exhaust air being delivered through a cowl a good way above decks. The vessel will be fitted throughout with an electric light installation by Messrs. J. H. Holmes & Co., Newcastle-on-Tyne; the whole of the cabin, engine and boiler rooms, galley, chart and wheel-house, binnacle, and telegraph being included. In addition, she will have a 20 in. projector, and the necessary lighting for navigating the Suez Canal at night. In order that all parts of the ship may be thoroughly examined after cargo has been discharged she will be provided with a number of portable lamps. The cabin, forecastle, and petty officers' rooms will be all heated by steam so as to avoid any risk of fire. The accommodation of captain, officers, and the saloon are under the shade deck. The engineers' rooms in a large house on deck aft, and the crew forward. A patent steam steering gear will be fitted amidships, and screw gear aft, patent steam windlass, by Emerson Walker & Co., two donkey boilers, patent stockless anchors, and in addition to all the necessary fittings and outfit for the oil trade, there will be a complete outfit for working general cargoes, including six steam winches. Three masts will be fitted and neatly rigged, and awnings all fore and aft for the Eastern climate. Great care has been taken to ensure strong and sound work. The rivetting is closely spaced in shell plating, decks and bulkheads, and in order to reduce as far as possible the number of joints in way of the oil tanks, most of the shell plates are nearly 30 ft. long. The vessel will be fitted with a very powerful set of triple-expansion engines of the well-known type manufactured by the Central Marine Engine Works of Wm. Gray & Co., Limited. The cylinders will be 26 in., 42 in., and 70 in. in diameter respectively, and of 45 in. stroke. An extra large amount of boiler power also is provided in the shape of three large single-ended boilers, working at a pressure of 160 lbs. per square inch. Increased safety is ensured by placing two of the boilers with their backs towards the coffer-dam, removing the heat of the stokehold a considerable distance from the bulkheads. The engines are capable of driving the ship at a high rate of speed when loaded, and are furnished with all the latest improvements. The engine-room contains also one of Mudd's new patent feed-water evaporators, which is designed on a plan greatly facilitating cleaning and examination. The vessel and machinery have been built under the superintendence of Messrs. Flannery, Baggallay & Johnson, of London. The ceremony of naming the steamer *Elax* was gracefully performed by Miss Winifred Baines, of West Hartlepool.

Eva.—On April 18th Messrs. Ropner & Son launched a steel screw steamer of the following dimensions, viz:—Length over all, 333 ft.; breadth, 41 ft. 6 in.; depth moulded, 24 ft. She will be classed 100 A1 at Lloyd's, has raised quarter-deck, and partial awning-deck; cellular bottom for water ballast, is built on the web-frame system, and will have all the latest improvements for a first class cargo steamer. Her engines are by Messrs. Blair & Co., Limited, on the improved triple-expansion principle of 1,100 I.H.P., with two large steel boilers working at 160 lbs. The steamer has been built for foreign account, and was christened *Eva* by Mrs. Robert Ropner, of Hartburn.

Lais.—On April 18th there was launched by Messrs. Charles Hansen & Sons, at West Cowes, a composite racing yacht, from the design of Mr. William Fife, jun. The principal dimensions are:—Length over all, 84 ft.; length on load water-line, 60 ft.; breadth, 17 ft.; and draught, 12 ft.; and her tonnage for racing rating is 40 tons. The yacht has been built to the order of Mr. John Gretton, jun., and was christened *Lais.*

Warren Hastings.—On April 18th, the Naval Construction and Armaments Co. launched from their yard at Barrow the troopship *Warren Hastings*, which has been built for the Secretary of State for India. The designs and construction of the vessel have been carried out under the direction and superintendence of Sir Edward Reed, M.P. The vessel, which received its name at the hands of Lady Agnes Burnet, is 350 ft. long, 49 ft. wide at her beam, and 36 ft. 9 in. in depth. She is fitted with twin screws, and is subdivided into 33 watertight compartments, rendering her practically unsinkable. The woodwork is entirely of teak to adapt her to a tropical climate. Accommodation is provided for 900 European troops, or 1,050 native troops, besides 29 officers and six ladies. Electric lighting is fitted throughout the vessel. She will be armed with six quick-firing guns, six 3-pounder, and four five-barrelled Nordenfeldt guns. She is fitted with two sets of triple-expansion engines, and will steam about 16 knots.

Bannockburn.—On Thursday, April 20th, there was launched from the Cleveland dockyard of Sir Raylton Dixon & Co., of Middlesbro', a steel screw-steamer which has been built to the order of the Montreal Transportation Co., of Montreal. The principal dimensions are:—Length, 254 ft.; beam, 40 ft.; depth moulded, 21 ft. 4 in.; with a deadweight carrying capacity of over 2,700 tons. She has been built under special survey for Lloyd's highest class. Engines will be fitted by the North Eastern Marine Engineering Co., Limited, of Wallsend-on-Tyne, the cylinders being 21 in., 34 in., and 56 in. by 39 in. stroke, with two large boilers working at a pressure of 160 lbs. per square inch. This steamer has an unbroken deck all fore and aft, with the exception of a top-gallant forecastle for the accommodation of the crew; and a sunk poop aft, handsomely fitted up for the accommodation of the officers and passengers. She has been constructed specially for trading on the great lakes of North America, and in order to get the vessel on her station she will require to pass locks on the St. Lawrence which are much too short for her length. Efficient provision has, therefore, been made for cutting the steamer in two portions, each of which will float at a suitable draught, and after these obstacles to navigation have been passed she will be again rivetted together. She is rigged as a three-masted schooner, and has a large number of handy hatches to fit her for her special trade. As the steamer was leaving the ways she was named the *Bannockburn* by Miss Keith Glen, of Greenock.

LAUNCHES—Scotch.

Cymric.—On March 20th Messrs. W. Thomas & Sons launched at Amlwch Port, the iron barquentine *Cymric*. Her dimensions are:—116 ft. by 24 ft. by 11 ft.; 175 tons register, and 380 tons deadweight.

Marathon.—On March 29th Messrs. Russell & Co. launched from their Greenock yard a steel sailing ship, called the *Marathon*, for Messrs. Wm. Thomson & Co., St. John, N.B. Her dimensions are:—Length, 260 ft.; breadth, 40 ft.; depth, 25 ft.; 1,850 tons register, and 3,200 tons carrying capacity. The vessel is fitted with Lambie's patent ports and American capstans.

Hardy, Topaz, and Pomegranate.—On March 30th Messrs. Stevenson & Asher launched at Macduff three fishing boats of the *Zulu* carvel build, and of similar dimensions, viz.:—Length of keel, 51½ ft.; over stems, 67 ft.; breadth of beam, 18 ft. 10 in.; and depth of hold, 8½ ft. The owners are:—(1) *The Hardy*, BF. 1,620 tons, John Smith (Boggin), Gordonsburgh; (2) the *Topaz*, BF. 1,645 tons, William Imlach, Portessie; (3) the *Pomegranate*, BF. 1,648 tons, George Thomson ("Law"), Buckie.

Irk and Medlock.—On March 30th the two powerful dredgers, named respectively the *Irk* and *Medlock*, were successfully floated in the Salford Docks of the canal, where they have been built. Both of these dredgers were constructed by Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley. They were put together at the firm's yard at Paisley, taken down, forwarded by rail in pieces to Salford Docks, and finally completed in the bed of the canal. Each of these dredgers is capable of raising 500 tons per hour of material from a depth of 30 ft. They are to be immediately set to work to complete deepening operations on the canal.

Sprightly.—On March 30th there was launched by Mr. George Duncan, at Bankhead, Macduff, a fishing boat of the *Zulu* build, and of the following dimensions:—Length of keel,

48½ ft.; over all, 62½ ft.; breadth of beam, 17 ft. 9 in.; and depth of hold, 9 ft. She was named the *Sprightly*, and is owned by Mr. S. Runcie, Cullen.

C. P. A. Koch.—On April 1st Messrs. Lobnitz & Co. launched at Renfrew a screw steamer 231 ft. long by 31 ft. beam, for the United Steamship Co., of Copenhagen. This vessel is arranged with cabins for 130 first-class and 30 second-class passengers, and will be fitted with triple-expansion engines. She was named *C. P. A. Koch*.

Steel Screw Tug.—On April 1st there was launched by Messrs. Anderson, Laverick & Co., Limited, at St. Lawrence, Newcastle, a steel screw tug, built to the order of Messrs. John Stewart & Sons, Limited, London, who themselves will supply and fix on board triple-expansion engines of 425 I.H.P.

Matin.—On April 3rd a large steel screw-steamer, named the *Matin*, was launched from the shipbuilding yard of Messrs. Gourlay Brothers & Co., Dundee. The vessel, which was built to the order of Messrs. R. A. Mudie & Sons, Dundee, is of the following dimensions:—Length, between perpendiculars, 362ft. 9 in.; breadth, moulded, 45 ft.; depth, moulded, 29 ft. 6 in. The tonnage of the vessel is about 3,900, and is capable of carrying about 5,400 tons of cargo. She has been built according to Lloyd's three-deck rule, and on the cellular double-bottom principle. The *Matin* has a half poop, bridge deck, and forecastle, and under the bridge deck are the saloon, the staterooms, and the accommodation for the captain, officers, and engineers. The engines will be triple-expansion, and will indicate about 2,000 H.P. Steam is to be supplied at a working pressure of 160 lbs. per square inch from two steel boilers.

Morven.—On April 3rd Messrs. Robert Duncan & Co., Port-Glasgow, launched a four-masted steel barque of 2,000 tons register, to carry 3,600 tons cargo, of the following dimensions: Length, 270 ft.; breadth, 42 ft.; depth 24 ft. 6 in. This vessel, which is built to the order of Mr. Robert R. Paterson, Greenock, is to replace the *Oceana*, which was lost last year. Construction was superintended by Captain Page, formerly of the *Oceana*, and who will now command the new vessel. The ceremony of naming the vessel *Morven* was gracefully performed by Miss Bessie Paterson, Greenock. The *Morven* was afterwards towed into the East Harbour, Port-Glasgow, to mast and fit out. At the luncheon after the launch, Mr. Paterson, in proposing "The health of the Builders," said this was now the seventh vessel Messrs. Robert Duncan & Co. had built for him, and all their dealings had been of a most harmonious nature.

Maggie Barr.—On April 5th there was launched from the yard of Messrs. Murdoch & Murray, Port-Glasgow, for Messrs. R. B. Ballantyne & Co., Glasgow, a steel screw-steamer of the following dimensions, viz.:—142 ft. by 23 ft. 6 in. by 10 ft. 6 in. moulded, built to the highest class at Lloyd's under special survey. This vessel is intended for the coasting trade, and will be fitted with powerful engines to maintain a speed of 12 knots. As the vessel left the ways she was named the *Maggie Barr*, by Miss Maggie Barr, daughter of one of the shareholders. Immediately after the launch the vessel was taken in tow for Glasgow, where the machinery will be put on board by Messrs. Muir & Houston.

Ems.—On April 6th Messrs. Charles Connell & Co. launched at Whiteinch a steel sailing ship of about 1,820 tons register, built to the order of Mr. James Nourse, shipowner, London. This vessel is a repeat of the *Arno*, launched recently for the same owner. She was named *Ems*.

Spinel.—On April 6th there was launched by Messrs. Scott & Sons, at Bowling, a screw-steamer named *Spinel*, built to the order of Mr. William Robertson, 15, Gordon Street, Glasgow, for his general coasting trade. The dimensions of the vessel are 175 ft. by 26 ft. 6 in. by 13 ft. Triple-expansion engines are being supplied by Messrs, Muir & Houston, Glasgow.

Princess May.—On April 7th Messrs. Barclay, Carle & Co. Limited, launched from their shipbuilding-yard, Whiteinch, a handsome saloon paddle steamer, built to the order of the Brighton, Worthing, and South Coast Steamboat Co., Limited, Brighton, for passenger and pleasure excursion traffic on the South Coast. The vessel is fitted with large saloons, deck cabins, and smoking-room. The dining saloon is fitted in polished hardwood, with handsome saddle-back upholstery; the deck saloons in old gold plush, with lincrusta ceilings and panels. She is fitted with powerful steam and hand combined steering gear, enclosed in handsome bridge-house, also steam-windlass forward and steam capstan aft on main deck. The vessel is constructed in accordance with the Board of Trade requirements, and will be provided with Channel passenger certificate. One feature in this steamer deserving special notice is that she is classed to the special requirements of the Board of Trade Bulkhead Committee on first or highest grade, which renders her practically unsinkable. Her dimensions are:—160 ft. by 21 ft. 6 in. by 8 ft. 9 in. On leaving the ways she was named the *Princess May* by Mrs. Lee, Brighton, wife of Captain Lee, managing director. The vessel thereafter was towed to the crane to be fitted with her machinery, which will be supplied by the builders. The engines are compound surface-condensing, and fitted with all the latest improvements.

Princess Margaret.—On April 17th, Messrs. Scott & Co. launched at Greenock a paddle steamer of 254 tons gross, and of the following dimensions:—Length, 170 ft.; breadth, 22 ft.; and depth, 9 ft. The new vessel, which has been built to the order of the London and South-Western and London, Brighton, and South Coast Railway Companies, is intended to run between Portsmouth and the Isle of Wight. She was christened *Princess Margaret*.

Arabistan.—On April 17th Messrs. Alex. Stephen & Sons launched at Linthouse a steel screw steamer, spar-deck type. Dimensions—325 ft. by 42 ft. by 29½ ft., and about 3,300 tons gross, built to the highest class in Lloyd's. The vessel has a half poop for captain and officers' rooms, saloon, state-rooms, &c., and housing under bridge for engineers, &c. The accommodation is all handsome, comfortable, and airy, special attention having been given to ventilation. She has all the best fittings and appliances which make the first-class modern steamer so effective in actual service. The engines are of triple-expansion type, having cylinders 24 in., 39 in., and 64 in. diameter by 42 in. stroke, with ample boilers suitable for a working pressure of 160 lbs. The steamer has been built to the order of Messrs. F. C. Strick & Co., Limited, London, and is intended for the Persian Gulf trade. She was gracefully named the *Arabistan* by Miss Haig Dollarfield Dollar.

Royal Sovereign.—On April 17th the Fairfield Shipbuilding and Engineering Co. launched from their yard at Govan the *Royal Sovereign*, a swift passenger steamer, built to the order of the London and East Coast Express Steamship Service Limited, and intended to be run in connection with the vessels of the Victoria Steamboat Association, on which service the *Kohinoor* last year proved so great a success. The *Royal Sovereign* is 310 ft. in length, 61 ft. in breadth, including the paddle-boxes, and 19 ft. in depth. She is built entirely of steel, in ten watertight compartments, which, as was proved in the case of the *Kohinoor*, renders her unsinkable. Steam-steering gear, warping capstans, and all other modern appliances are included in the steamer's outfit. The deck saloons forward and aft of the machinery space supports an unbroken promenade deck 290 ft. in length. The after-deck saloon, carried out to the sides, is fitted for first-class passengers in the most luxurious manner. Underneath is the dining saloon, seated for 170. This room is 8 ft. in height, and is well ventilated. The forward deck saloon, with light and well-ventilated dining accommodation underneath, is fitted up in corresponding style for second-class passengers. The vessel is lighted throughout by electricity, and there is a complete system of electric calls. The launching ceremony was gracefully performed by Miss Barnwell, Thurlaston, Kent.

Cumberland.—On April 18th there was launched by Messrs. J. Fullerton & Co., from their yard at Paisley, an iron screw-steamer of about 400 tons, built to the order of Messrs. James J. Mack & Sons, Liverpool, for their coasting trade. The vessel has been built in excess of the highest class at Lloyd's, under special survey, with all the latest improvements, steam windlass, and steam steering gear, and will be fitted by Messrs. Ross & Duncan, Whitefield Road, Govan, with a pair of compound engines of 65 N.H.P. On leaving the ways Miss Jolly, Greenhead House, Govan, named the steamer the *Cumberland*.

Lota.—On April 18th Messrs. Russell & Co. launched from Kingston Yard, Port-Glasgow, a three-masted barque of 1,520 tons net. to carry 2,720 tons cargo, named *Lota*, for Messrs. M'Donald, Adams & Co., Greenock. Dimensions:—Length, 246 ft.; breadth, 37 ft. 6 in.; depth, 22 ft. 6 in. The vessel was built under the superintendence of Mr. Wright, surveyor. The outfit will be completed, and the vessel will load in the James Watt Dock.

Etruria and Knight Templar.—On April 19th Messrs. Mackie & Thomson launched at Govan a screw steam-tug, of about 140 tons, for Mr. Prendiville, Liverpool, named the *Knight Templar;* and a screw steam trawler, of 150 tons, for the Great Grimsby and East Coast Steam Fishing Co., named the *Etruria.*

Britannia.—On April 20th Messrs. David and William Henderson & Co. launched from their yard at Partick the composite cutter racing yacht *Britannia*, which they have built for the Prince of Wales from designs by Mr. G. L. Watson. The length on the load water-line is 86 ft., and the tonnage by yacht measurement about 220. The vessel is tastefully but plainly fitted up, the saloon being from designs by Mr. G. L. Watson, F.R.I.B.A., Glasgow. The beam permits of a spacious dining saloon extending the full width. This is framed in mahogany, with panels of cretonne. Aft of the dining saloon is the Prince's private cabin and bath-room, another state-room, a smoking-room, a cloak-room, and a ladies' cabin, all of which are handsomely finished and furnished. Forward of the dining saloon are the captain's room and mess-room. The forecastle is fitted up for a large number of men. Under the cabin floor are the store rooms, fresh water tanks, coal bunkers, &c. The vessel carries three boats.

Deirdre.—On April 20th Messrs. John Reid & Co., Limited, Whiteinch, launched a 20-rater, composite racing yacht for the Right Hon. the Earl of Dunraven. This vessel, which was named the *Deirdré*, has been built to the design of Mr. G. L. Watson, and will be placed under the experienced command of Captain Richard Cranfield.

Sweet Home.—On April 20th there was launched from the shipbuilding yard of Messrs. Scott & Sons, Bowling, a finely-modelled screw-steamer, 108 ft. 6 in. by 20 ft. by 9 ft. 6 in. to Lloyd's highest class, built to the order of Mr. John Robertson. Peterhead, for trading between the ports of Leith and Peterhead. The engines, which are compound surface-condensing, are being supplied by Messrs. Ross & Duncan, Govan. On moving into the water the steamer was named *Sweet Home* by Mrs. Robertson, wife of Captain Robertson, who is to command the vessel.

LAUNCHES—Irish.

Sarmiento.—On Saturday morning, April 1st, at high water, the steel screw steamer *Sarmiento* was successfully launched by Messrs. Harland & Wolff, from the south end of the Queen's Island, Mr. Hugh Brown being present on behalf of the owners. The vessel has been built for the Pacific Steam Navigation Co., and is intended for their cargo service between Liverpool and the west coast ports of South America. Her gross tonnage is 3,580. She will have two masts, schooner rigged, and will be provided with steam windlass, and also with steam winches and every facility for the rapid handling of cargo. The triple-expansion engines for the *Sarmiento*, which have an I.H.P. of 1,900, have also been constructed by the builders, and the propeller is of manganese bronze. This is the fourth steamer launched from the Queen's Island for the Pacific Steam Navigation Co. within the past four months.

Magic.—On April 20th, at noon, the s.s. *Magic* was launched by Messrs. Harland & Wolff from the southern end of the Queen's Island. This vessel has been built for the Belfast Steamship Co.'s service between Belfast and Liverpool, and will, by her ampler and superior accommodation and increased speed, mark a distinct advance in that service. She is 310 ft. long, and 38 ft. in breadth. Her gross tonnage is about 1,750, and she is built to Lloyd's highest class. Accommodation will be provided in staterooms for about 220 first-class passengers. The saloon will be an elegantly-furnished room on the bridge deck in front of the machinery spaces, and on the same deck, further aft, will be the smoke-room. On this deck also will be a number of staterooms, the remaining staterooms being placed on the upper and lower decks. The air in these rooms will be kept pure and fresh by means of mechanical ventilation, and all the rooms, as indeed the entire ship, will be lighted with the electric light. Above the bridge deck, and over the saloon, there will be a promenade for passengers, and here also the captain's room will be located. The accommodation for steerage passengers is placed in the poop, and the crew are berthed forward in the forecastle. The *Magic* has also large capacity for cargo, and all requisite means for rapid loading and discharge, including four hatches and steam winches. In addition, there is accommodation for a large number of cattle and horses. She will be propelled by two sets of triple-expansion engines, and manganese bronze propellers, which have been constructed by the builders. Altogether, the *Magic* will be an important addition to a service that has been growing so largely and steadily for a number of years past.

LAUNCH.—American.

City of Alpena.—On March 14th there was launched from the yard of the Detroit Dry Dock Co., Detroit, Mich., U.S.A., the paddle passenger steamer *City of Alpena*, built for the Detroit-Mackinaw service of the Detroit and Cleveland Steam Navigation Co. The vessel is 280 ft. long, 70 ft. beam over all, and 15 ft. deep. Motive power is supplied by a set of compound engines of 3,000 H.P., having cylinders 42 in. and 66 in. diameter, by 11 ft. stroke.

LAUNCH.—French.

Lion.—On April 1st there was launched from the Graville shipbuilding yard at Havre, France, the petroleum-in-bulk-carrying steamer *Lion*, built for Messrs. Deutsch & Co., Paris and Rouen. The vessel, which is constructed of steel, is 278 ft. 9 in. long, 39 ft. 8 in. beam, 28 ft. deep, and has a carrying capacity of 2,800 tons of petroleum. Motive power will be supplied by a set of triple-expansion engines of 1,200 H.P. by which a speed of 9½ knots is expected to be attained.

LAUNCH.—German.

Electra.—On the 2nd March, the Flensburg Shipbuilding Co. launched a steel cargo steamer, 240 ft. by 34 ft. by 17 ft. 2 in., built for Messrs. Holm & Molzen, in Flensburg.

LAUNCH.—Danish.

Frode.—There was lately launched from the yard of the Burmeister and Wain Shipbuilding and Engineering Co., Copenhagen, the steel cargo steamer *Frode*, built for the Gorin Steamship Co., Copenhagen. The vessel is 284 ft. long, 38 ft. beam, and 20 ft. deep. Motive power will be supplied by a set of triple-expansion engines of 1,000 H.P.

LAUNCH.—Austrian.

Trieste.—On April 1st there was launched from the yard of the Austrian Lloyd Co. at Trieste the screw steamer *Trieste*. The vessel, which is constructed of Siemens-Martin steel, is 212 ft. long, 30 ft. beam, and 17 ft. deep, with a displacement of 1,200 tons. Motive power will be supplied by a set of triple-expansion engines of 900 H.P., by which a speed of 12 knots is expected to be attained. The vessel, which is intended for service on the River Narenta, is lighted throughout by electricity, and has accommodation for 44 first-class, 22 second-class and 200 third-class passengers.

TRIAL TRIPS

Progress.—On the 11th March a fine screw steamer, built for Mr. M. Struve, in Blankenese, by the Flensburg Ship building Co., was taken on trial trip. She has dimension 216 ft. by 31 ft. by 21 ft. 6 in., and 450 H.P., triple-expansion The trial was very successful; the steamer made an average speed of 10¼ knots. The *Progress* is now on her way to the China coast where she is intended to trade.

Septima.—After extensive repairs of this steamer, being supplied with new triple engines, boilers, new deck, cabin arrangement, new masts, &c., she was taken by the Flensburg Shipbuilding Co. a trial trip on the 18th March. *Septima* was the first steamer which was built by the Flensburg Shipbuilding Co. Her hull was in a very good condition, and as the ship had always been a successful one, the owners, Flensburg Shipping Co. of 1869, wished to keep her in their fleet and ordered new engines, 500 H.P., by the Flensburg Shipbuilding Co. On the trial an average speed of 10½ knots was obtained.

Turquoise.—On March 24th this screw-steamer, built by Messrs. J. Shearer & Son, of Kelvinhaugh, for Mr. W. Robert-

son, of Glasgow, had her trial trip. The vessel ran the measured mile and developed a speed of 10·811 miles per hour. The engines, which are of the triple-expansion type, were built by Messrs. Walker, Henderson & Co., of Bishop Street, Glasgow.

Clan Maclean.—On March 28th the Clan Line steamer *Clan Maclean* sailed for Liverpool and Bombay with a general cargo. Before proceeding on her voyage the steamer ran a series of trials to test the new machinery, which has been fitted on board the steamer by Messrs. Bow, M'Lachlan & Co., of Thistle Works, Paisley. Besides new machinery, the hull and general arrangements of the steamer have been very largely improved both as to utility and comfort, thus entitling the steamer, although an old one, to take her place as to speed and comfort with any modern vessel of her class. The new engines are of the tri-compound type, with cylinders 22 in., 37 in., and 61 in., with a stroke of 42 in., working at a pressure of 130 lbs. per square inch. The boilers are two in number, with one large donkey boiler. They are fitted with Howden's system of forced draught. Weir's feed heater and exaporator are also fitted. During the day's trials the engines worked with the utmost smoothness, and at no part of the trial had water to be used on any of the bearings. The mean of the runs on the measured mile showed a speed of 12·121 knots, which was very much better than had been expected and was judged highly gratifying by the managers, Messrs. Cayzer, Irvine, & Co., and their superintendent engineer, to whose specification and under whose superintendence the engines were made and fitted up. Immediately after the completion of her trial the steamer proceeded to Liverpool.

Hebdomas.—This new steamer, built by the Flensburg Shipbuilding Co., was taken on trial trip on the 28th March. She has dimensions 240 ft. by 34 ft. by 17 ft. 2 in. and 500 H.P., was built for the Flensburg Shipping Co. of 1869 for the Baltic trade. On the trial she attained an average speed of 10 knots.

Tritonia.—On March 30th the new Donaldson liner *Tritonia*, built and engined by Messrs. D. & W. Henderson & Co., Partick, went her trial trip on the Firth of Clyde. The results were in every respect satisfactory, and with 3,500 tons deadweight on board a mean speed of over 12 knots was obtained, which was in excess of contract. The dimensions are as follows:—377 ft. between perpendiculars; breadth moulded, 46 ft.; depth moulded, 31 ft.: and deadweight capacity. 5,640 tons. The engines are 26, 43, and 20 by 54 in. stroke. The two boilers are fitted with Messrs. Howden's forced blast. The engines are also fitted with Messrs. Weir's evaporator, feed-heater and feed-pumps. The *Tritonia* being specially built for the cattle trade, the utmost attention has been paid to everything which would conduce to the safe carriage and comfort of live stock, so that the animals may land in the best condition for market. The cattle pens are of a permanent nature, and a new feature is the laying of the decks with cement, into which footboards are spaced. Special care and attention have been paid to the matter of ventilation, and the improved combination system of mechanical ventilation of Messrs. Baird, Thompson & Co., of London and Glasgow, has been introduced throughout. The system was in operation during the trial, and worked satisfactorily. The ship is lighted throughout with electric light.

Mystic.—On April 1st the new twin-screw steamer *Mystic*, built by Messrs. Harland & Wolff for the Belfast Steamship Co., Limited, went on her trial trip. She is 220 ft. long, 29 ft. beam, and 26 ft. deep, and is propelled by twin engines. She has been specially designed and constructed for the cross-Channel trade between Belfast, Londonderry, Liverpool, and Manchester, and will carry between 600 and 700 tons deadweight and 250 head of cattle. After the adjustment of the compasses the steamer went on a run, the speed averaging about fourteen knots.

Emily.—On April 3rd the s.s. *Emily*, recently launched by Messrs. John Fullerton & Co., Paisley, engined by Messrs. Ross & Duncan, Govan, and built to the order of Messrs. Wilson & Symonds, Cardiff, went down the river on her official trial trip. After adjusting compasses the steamer took on board at Gourock a numerous company, and proceeded to the Gareloch, where the measured mile was run, a mean speed of 10½ knots being attained. Dinner was then served, and after a pleasant cruise down the Firth the vessel proceeded to Glasgow in the evening.

Eureka.—On April 4th the screw tug *Eureka*, built by Messrs. William Hamilton & Co., Port-Glasgow, which is intended for towing purposes on the river St. Lawrence, went down the Clyde for the purpose of testing her engines, and after various runs on the measured mile at Skelmorlie, her mean speed was found to be 11¼ knots per hour, which is 1¼ knots above the guarantee. The owners expressed themselves as highly satisfied with the boat and machinery. She is expected to sail in a few days for Canada.

Vanland.—On April 6th the Campbeltown Shipbuilding Co.'s screw steamer *Vanland*, of 772 tons nett register, and 1,950 tons deadweight, recently launched from their yard at Campbeltown, Clyde, made her trial trip, when an average speed of 11½ knots was attained with 300 tons on board The *Vanland* is a steel screw steamer of the part awning deck type, designed to carry 1,950 tons deadweight on 16 ft. 7 in. draught, and has been supplied with a set of triple-expansion engines by Messrs. Kincaid & Co., Limited, engineers, Greenock. All the latest improvements for navigating the ship economically, and for the speedy loading and discharging of cargo have been supplied. A large party of ladies and gentlemen were on board, among them being Mr. Edward Carlson, of Messrs. C. & E. Carlson, Glasgow, and Captain C. von Below, representing the owners, Messrs. Angfartygs Aktiebolaget Svithiod, of Gothenburg. The usual toasts were proposed and responded to, much satisfaction being expressed with the vessel by the representatives of the owners present. The *Vanland* is intended to trade between Liverpool and Gothenburg, for the latter of which ports she leaves immediately.

Skeffington.—On April 7th the screw steamer *Skeffington* just completed by Messrs. Wood, Skinner & Co., of Bill Quay, for Messrs. John O. Scott & Co., of Newcastle-on-Tyne, was taken on her trial trip. She had a very successful run to Coquet Island, and thence returned to Howdon Dock to take in a coal cargo for Lubeck. The engines, which have been supplied by the North-Eastern Marine Engineering Co., and are triple-expansion, with cylinders 17½ in., 28 in., and 47 in., with 33 in. stroke, worked smoothly, and attained the speed contracted for, viz., 10 knots. The dimensions of the *Skeffington* are as follows:—Length, 206 ft.; beam, 32 ft.; depth, 16 ft. 4 in.; draught of water, 15 ft. (loaded); carrying capacity, 1,300 tons.

Hound.—On April 8th the Royal Mail steamer *Hound*, which has been built by the Fairfield Shipbuilding and Engineering Co., Limited, for Messrs. G. & J. Burns's accelerated mail service between Ardrossan and Belfast, went on her official trials. The contract speed was easily maintained, the mean on the measured mile being 15·10 knots. The vessel, which has been fitted with every convenience, will be placed at once on the Ardrossan station, where during the summer she will run in conjunction with the same company's s.s. *Hare*. The superior speed and comfortable accommodation of the *Hound* will doubtless make the service more popular than ever.

Athlete.—The present beautiful weather adapts itself excellently to throw an interest and a glamour upon all trial trips lately carried out. We are pleased to report that the trial trip of the new steam-tug *Athlete* was happily effected upon the 15th April under the most favourable aspects both as regards the behaviour of the vessel and the charming weather attending the trial. This steam tug both to its hull and its machinery is the work of Messrs. John Stewart & Son, Limited, of Blackwall Iron Works, for a well known tug owner, Dr. Brownfield, of Poplar, for whom this firm had already built a smaller tug of which the owner speaks in the most flattering terms. The *Athlete* is of steel, to Lloyd's highest class, its length between perpendiculars being 92 ft., with a beam of 19 ft. 6 in., and a depth of 11 ft. 6 in. moulded. She is fitted with triple-expansion screw engines of very strong and elegant design, of which the cylinders are 13 in., 21 in., and 34 in. diameter respectively, by 24 in. stroke. The boiler is of steel, with three furnaces to Lloyd's requirements, carrying 160 lbs. working pressure. We were glad to note as regards details, that exceptional space had been left all around the under side of the shell for convenient examination at any time *in situ*. The draught was exceptionally good, burning Welsh coal freely, and there was no trouble in keeping up the steam pressure even when pressed to the highest speed, and no signs of priming or other trouble. A large and representative company were present to see the trial trip, including, of course, the owner, Dr. Brownfield, who was much pleased with the results, and representatives specially

sent by the Admiralty and Lloyd's. Upon the trial trip over the measured mile the *Athlete* made 16·07 knots with the tide, and 10 knots against it, giving a mean of 13 knots, the engines indicating 500 H.P., and going well within herself. We were much pleased with the rapid and convenient action of the reversing gear which was operated by a steam cylinder in the engine-room with hydraulic dash-pot or brake, and the action upon the engines to stop or reverse was most prompt and of easy manipulation. The vessel has all the appearance of a good sea-boat, and further, gives a great impression as to her towing capabilities under great strain, which is not by any means the same thing as design for speed. All the fittings were of excellent quality and finish, an unusual quantity of teak having been apparently used in her fitting up. We trust Messrs. Stewart & Son's excellent designs and workmanship will help to bring back much vanished business to the Thames.

Campania.—On April 15th the Cunard Royal Mail steamer *Campania* went on her farewell cruise, preparatory to leaving the Clyde, and though a profound and judicious silence was maintained as to the actual speed obtained, it is certain that 23½ knots is under, not over the mark, though both builders and owners preferred to let her first outward trip speak for itself. On the invitation of the builders, a company which was of the most representative kind, left the Central Station, Glasgow, at ten o'clock. From Gourock one of the Caledonian Steam Packet Co.'s steamers conveyed the guests to the *Campania*, which had been brought to midway between Kilcreggan and Gourock, and in about an hour everybody was on board. Amongst those present were the Marquis of Ailsa, Sir John Burns, Bart., Sir William G. Pearce, Bart., M.P., Sir W. B. Forwood, Sir William M'Onic, Sir William Arrol, Sir Donald Matheson, K.C.B., Sir William Renny Watson and Lady Watson, Mr. Richard Barnwell, managing director of the Fairfield Co., and Mrs. Barnwell, Mr. William Houldsworth, Rosele, Ayr; Lord Provost Russell, Edinburgh; Captain White and Mrs. White, ex-Lord Provost Ure and Mrs. Ure, Captain Williamson, of the Caledonian Steam Packet Co.; Mr. John List, Captain Wisely and Mr. George Scott, of the Castle Line; Mr. and Mrs. J. C. Reddie, Mr. R. Muirhead, Northern Lighthouse Board; Mr. Nathaniel Dunlop, Mr. Robert Shaw Stewart, North Berwick; Colonel Thomas Vickers, Sheffield; Consul Schlick, Hamburg; Inspector Ritschards, Hamburg-American Co.; Mr. T. J. Dodd, Mr. G. J. P. Thearle and Mr. James Mollison, of Lloyd's; Commander Deverell, Mr. F. Worth, of the Admiralty; Professor Jamieson, Professor Barr, in fact almost everybody interested in the success of the vessel who could spare the time. There was no attempt made to run the boat up to her reputation, though for a brief space full power seemed to be exerted, and that almost without the slightest vibration, a marvellous example of the strength of hull considering the weight of the moving machinery. The dimensions of the engines are now familiar to all our readers, and without being able to give particulars of the vacuum, steam or revolutions, or in fact any data, this account is lacking in interest to all. One feature, however, could be noted, and that was the ease with which steam could be kept, and the wonderful coolness of the engine and boiler spaces. At the luncheon in the Grand Saloon, the Chairman, Sir Wm. G. Pearce, Bart., M.P., in giving the toast "Success to the *Campania*," said:—The vessel is the sixteenth large Atlantic greyhound which the Fairfield Co. has built. Although the task set them when they received the order for these gigantic vessels was no doubt a difficult one, it would be readily understood that with all their experience, and the enormous plant at Fairfield, they were confident that they would be able to turn out something like what they saw—something that would, he believed, prove unequalled. The first requisite that was asked was safety, for it was the proud boast of the Cunard Line that in its Transatlantic traffic it had never lost a life. Before all things it placed the safety of the passengers and crew. The next consideration was that of speed, and in that respect he intended to let the vessel speak for herself. He should only say that the trials they had gone through were thoroughly satisfactory to the builders, and he was quite sure their opinion would be endorsed by their good friends of the Cunard Co. In conclusion, he had to offer them his sympathy on one matter. He understood that the heavy subsidy they had been receiving for the *Umbria* and *Etruria* was about to be withdrawn, for the reason that when the *Campania* and *Lucania* entered the service of the Cunard Co. there was no further necessity of continuing the payments for the older pair. That appeared to him a weak form of economy. They had already seen two large Atlantic liners that were under subsidy to the Government put under a foreign flag, and now it was proposed to give up one more—the *Umbria*. He considered that a matter to be pressed further and in another place. All who had large stakes in the commercial welfare of the country ought to see that the question of the protection of our maritime resources in time of war was thoroughly thrashed out, and that the Government was held responsible if in the future shipowners refused to build to certain specifications, because they did not know when their vessels were to be thrown aside by any Board of Admiralty which might be, as he believed this one was, in power for a short period. The most pleasurable fact, and the one on which he congratulated himself most, was that the relationship that existed in the time of his father still existed between Fairfield and the Cunard Co. He sincerely hoped that that state of matters would long continue. He was certain that the *Campania* would promote the business of the Cunard Co., whose success he was proposing when he proposed the ship. Sir John Burns, in reply, thanked the chairman of the Fairfield Co. for his kind words regarding the Cunard Co. He did not think he could pay the Fairfield Co. a higher compliment than to say that if the *Campania* and *Lucania*, with their vast power and great size, came up to what the *Umbria* and *Etruria* were in their day and generation the Cunard Co. would be entirely satisfied. After landing the company at Gourock, the *Campania* left the Tail of the Bank for the Mersey. The above vessel is coated on the bottom with Hartmann's Rahtjen's composition.

Oscar II.—On April 15th the large steel screw-steamer *Oscar II.* had her trial trip off Hartlepool. She is a fine vessel of the cargo-carrying type, and has been built by Messrs. William Gray & Co. Limited, to the order of Mr. Jacob Christensen, of Bergen, this being the third boat both built and engined by Messrs. W. Gray & Co. for the same owner. The vessel takes Lloyd's highest class, is replete with all the latest improvements now embodied in the construction and outfit of a modern cargo steamer, and is of the following dimensions:—Length over all, 327 ft.; breadth, 41 ft.; depth, 24 ft. Her engines are built on the triple-expansion principle, and of the type now so well-known, supplied by the Central Marine Engine Works of Messrs. W. Gray & Co. Limited. They will develop over 1,100 H.P., the cylinders being 25 in., 36½ in., and 62 in. diameter, and the stroke of piston 39 in. These engines are supplied with steam by two large single-ended steel boilers, working at a pressure of 160 lbs. per square inch. After taking on board a large party of visitors, chiefly personal friends of Mr. Christensen, the vessel proceeded to sea, and had her Sir Wm. Thompson's compasses adjusted by Mr. Baird. The engines were then started full speed ahead, the log thrown overboard and a run of a couple of hours made to test the running qualities of the engines. No hitch of any sort arose on the trial, the engines running without the application of water, and remaining perfectly cool throughout the whole trial. The vessel was found to have made an average speed of 11½ knots per hour.

City of Belfast.—On April 18th the new steamer *City of Belfast*, built by Messrs. Laird, of Birkenhead, for Messrs. James Little & Co., of Barrow-in-Furness, for the Barrow Steam Navigation Co., was taken on a four hours trial run on the Mersey. The vessel is intended for the mail and passenger service between Barrow and Belfast, in connection with the Midland and Furness Railways. She is a steel twin screw steamer, with straight stem and elliptical stern. Her dimensions are:—280 ft. by 32 ft. by 14½ ft., the gross tonnage being 1,065, and the net register tonnage 330·10. The machinery consists of two separate sets of direct-acting triple-expansion engines, the cylinder dimensions being 18 in., 22 in., and 42 in. respectively, with a 30-in. stroke. There are two boilers some 15 ft. by 17 ft., worked under forced draught at 160 lbs. pressure, and the contract I.H.P. is 2,500. At the trial a four hours' run was made, the measured mile being covered several times, and then a speed trial was made between the lightships. The contract was for 16 knots with 50 tons of cargo, and on the trial the vessels mean draught was 8 ft. 8 in., while her mean speed for the four hours came to a little over 17 knots. The vessel has been fitted up with all the latest improvements, including Mason's patent pivotted sidelight scuttles. The propellors are of manganese bronze.

Maggie Barr.—On April 18th the *Maggie Barr* (s.), built by Messrs. Murdoch & Murray, Port-Glasgow, and engined by Messrs. Muir & Houston, Glasgow, to the order of Messrs. R. B.

Ballantyne & Co., 212, St. Vincent Street, Glasgow, went on her trial trip. The vessel is of the following dimensions, viz.: 142 ft. by 23 ft. 6 in. by 10 ft., with compound surface-condensing engines, cylinders 20 in. and 40 in. by 27 in. stroke. At Gourock a large company of ladies and gentlemen joined the vessel, which then proceeded to Skelmorlie to run the measured distance, and there attained a speed of 12 knots.

Moya.—On the morning of April 20th the twin-screw steamer *Moya*, built by Messrs. Workman, Clark & Co., Limited, Belfast, proceeded down Belfast Lough for her official trial trip. The vessel has been built for the Commissioners of Irish Lights, and is specially designed for the maintenance of their service with the lighthouses on the southern and western coasts of Ireland. In order to withstand the severe weather to which these vessels are often subjected she has been built in excess of the strength required by Lloyd's highest class, and to the regulations of Board of Trade for passenger certificate. The dimensions of the vessel are:—Length, 126 ft.; breadth, 23 ft.; depth, moulded, 11 ft. 7 in.; gross tonnage, 184 tons. The vessel is divided into five watertight compartments by bulkheads extending up to the deck, there are also in addition two holds partitioned off, forward and aft of the machinery space for cargo. These holds are each provided with hatchways, opposite which in the bulwark are gangway doors. For heavy lifts, the fore hatch is provided with a derrick and gear worked from the steam windlass. The forward portion of the vessel is fitted up for the accommodation of the crew and firemen. Four rooms are also provided for the conveyance of the lighthouse keepers in the cabin. The saloon is aft, and has been handsomely panelled in polished walnut, and the sofas upholstered in leather. Immediately forward of the saloon, and entering from a lobby, are the captain's, engineers', and officers' cabins, each state-room comfortably fitted up. On deck, a bridge-house extends over the machinery space with a teak deck-house at front, containing the steering gear. Two large lifeboats fitted with patent disengaging gear are housed on the deck, and adapted for special landing work at the lighthouses. To protect the vessel from heavy seas washing over her, a turtle back forecastle extending about 20 ft. from the stem has been built. On this deck are placed the anchors, and these are worked from the steam windlass on main deck underneath by means of a crane. The machinery has been constructed at Messrs. Workman, Clark & Co.'s Engine Works, Queen's Road. The engines are two sets of compound direct-acting, with cylinders 16 in., and 30 in., by 18 in. stroke. Steam is supplied from a large steel boiler at a pressure of 110 lbs. The propellers are made of manganese bronze, and have each three blades. A preliminary trial was run over the measured mile course at Grey Point. The *Moya* then started on her six hours' continuous steaming, the result obtained being quite satisfactory, the speed showing 11½ knots per hour with the vessel fully equipped and loaded. The *Moya* has been specially designed and built under the superintendence of Mr. Wymer, of the Board of Trade, and Captain Galway, Inspector of Irish Lighthouses, who were present at the trial representing the Commissioners.

Iris.—On April 21st the *Iris*, a steel screw steamer, built and engined by Palmer's Shipbuilding Co., of Jarrow and Howdon, to the order of the Société Anonyme des Produit Resineux, of Antwerp, proceeded on her trial trip. The vessel is of the following dimensions:—Length, 296 ft.; breadth, 39 ft.; depth, moulded, 29 ft. 8 in.; gross tonnage, 2,345 tons. She is fitted with triple-expansion engines, with two boilers, having a working pressure of 160 lbs. A speed of 11½ knots was attained over the measured mile, which is considerably higher than the guaranteed speed.

Webster.—On Saturday, April 22nd, the fine large new steel screw steamer *Webster*, which has just been built for the West Hartlepool Steam Navigation Co. by Messrs. Wm. Gray & Co., Limited, of West Hartlepool, had her trial trip in Hartlepool Bay. This large vessel, of which we gave a full account on the occasion of her launch in our April number, is a first-class cargo-carrying steamer of above 5,000 tons deadweight capacity. The *Webster* is the twelfth vessel which has been built at the yard (formerly Messrs. Pile, Spence & Co.) now occupied by Messrs. Wm. Gray & Co., Limited, for the West Hartlepool Steam Navigation Co. and Mr. C. M. Webster, a connection which has been much valued both by the owners and the builders. Triple-expansion engines of 1,200 I.H.P., with very large boilers, have been fitted by the Central Marine Engine Works. The vessel was in ballast, having only bunker coals on board. After a couple of hours spent in adjustment of compasses, full speed runs were made with and against the tide, during which time the vessel made 11½ knots at a high number of revolutions, everything, as is usual with the machinery of this firm, running perfectly smooth, and without the application of water. The West Hartlepool Steam Navigation Co. were represented by their marine superintendent, Captain Wright, and superintending engineer, Mr. R. Newton, under whose inspection the vessel has been built. The builders were represented by Captain J. E. Murrell and Mr. J. C. Clarke. After landing the party, the vessel proceeded to Cardiff to load.

Hongkong.—On Saturday, April 22nd, the s.s. *Hongkong*, built to the order of La Société Service Subventionne des Correspondances Fluviales au Tonkin, by the Sunderland Shipbuilding Co., Limited, was taken out to sea on her trial trip. The vessel is 240 ft. by 32 ft. by 19 ft. 6 in., classed first-class French Veritas and English Board of Trade certificates for passengers' spar-deck grade. The vessel will be employed in the mail service between Haiphong and Hongkong. Accommodation for first-class passengers is placed amidships in teak houses, the dining saloon is most tastefully worked out in panels of solid oak, special attention has been paid to ventilation to suit the hot climate in which she will trade. The whole of the decks throughout are of teak. Engineers and officers' berths and mess-rooms are in a large teak deck-house aft, which is also entirely fitted up in hardwood. The main engines are by the North-Eastern Marine Engineering Co., Limited, Sunderland, having cylinders 20 in., 34 in., and 56 in. by 36 in. stroke, and during the whole of the trial worked in a most satisfactory manner, a pressure of steam of 160 lbs. was easily maintained, and for six consecutive hours the machinery ran at full speed without a stoppage of any kind or any indication of heating. The mean speed obtained upon this run was 12½ knots per hour, which more than fulfilled the guarantees, and gave entire satisfaction to all on board. A feed-heater and evaporator are fitted by Mr. Jos. Reed, of North Shields, who is both patentee and manufacturer, which worked most satisfactorily. The electric light installation has been supplied by Messrs. C. A. Parsons & Co., of Newcastle. During construction the vessel and her machinery have been superintended by Monseiur Krafft on behalf of the owners. The *Hongkong* is a sister vessel to the *Hanoi*, which left the builders' hands a month ago.

Reviews.

Kelly's Directory of Merchants, Manufacturers and Shippers. London: Kelly & Co., Limited. 1893.

The seventh issue of this semi-official publication brings down to date the information which previous issues have contained. Beyond the Directory proper, which is full and complete enough, the volume contains an immense mass of statistics bearing on the trade and commerce of the world. Like many other of our official publications, the Directory is more appreciated abroad than in its own country. A British Consul in Uruguay writes that "the merchants and manufacturers of England do not seem to avail themselves of the Directory as they might do. I am constantly receiving letters of inquiry for information that in most cases could be obtained from the Directory."

In our notice of the previous issue a year ago, we referred to the Editor's remarks on the effect that restrictive tariffs abroad were having on our commerce, with especial reference to the McKinley tariff. The evil results of that measure are well-known to our readers. They are noticeable in every department of commerce, and, as was only to be expected, the injury is not confined to British trade, but is seriously affecting that of the United States themselves. Whereas the dutiable articles imported into that country in 1891 were of a value of 478,674,844 dols., they had in 1892 fallen to 369,402,804 dols., a decrease of about thirty per cent. Trade to the value of no less than £28,700,000 sterling had been utterly destroyed, at least as far as the United States are concerned. It was probably destroyed altogether, and little of it would be diverted into other channels. Of course, as Great Britain is the chief customer and chief purveyor to America, the greater part of the loss falls on this country. In spite, however, of this, of the Argentine trouble, and of general depression everywhere, the decrease in British exports for the twelve months is about 19 millions sterling, or about 6½ per cent. on the total.

In the preface is printed an interesting summary of the regulations affecting foreign commercial travellers in various European countries. This is well worthy of attention. England is only now awaking to the fact that our goods ought to be adapted to the wants of our customers, and that the mere fact of excellence of manufacture will not force an unsuitable article. The secret of the advance of foreigners into fields peculiarly our own, has been due to their recognition of this fact. They examine the ground carefully, get to know the exact wants of the people, and then supply them with something inferior to that of British make doubtless, but at the same time cheaper, more showy, and perhaps more suitable to their requirements. The machinery of the Foreign Office is being used now for the useful purpose of developing trade, our manufacturers are being taught by hard times that they must not be too haughty, that there is no magic in the words "of British manufacture," and that they must follow the times. So it may come that in spite of hostile tariffs and Continental opposition, we may next year hear something of improved trade. It is too late to hope for much improvement this year, nor is any likely to come whilst the political atmosphere of the country is so unsettled a condition.

A Pocket Glossary of Technical Terms, English-French and French-English. By J. J. Fletcher. Second Edition, revised and enlarged. London: Crosby Lockwood & Co. 1893. Price 1s. 6d.

This tiny volume is in truth a pocket dictionary. We have seen books so described which would need such a pocket as an old-fashioned poacher delights in, to accommodate them. In the present case a watch or ticket pocket could easily contain the booklet. Yet the glossaries run to 160 pages, and contain words likely to be useful to the sailor, engineer, shipbuilder, architect, chemist and manufacturer. Besides this there is a great deal of useful information afforded. There are tables of weights, measures and money. And constants are given to enable the reader to convert quantities expressed in the measures of the one country into those of the other. Tables regarding the load on boilers, the properties of iron and steel as expressed here and on the other side of the Channel, and various matters of value to those engaged in the profession we have referred to are given. The work cannot fail to be of use to those who are engaged in matters relating to the other side the Channel, and its bulk being so small, the reader can only blame himself if it be not in his pocket when occasion demands its services.

The Mechanical Engineer's Pocket-book. By D. Kinnear Clark, M.I.C.E. London: Crosby Lockwood & Co. 1893.

In fourteen months it has been necessary to produce a second edition of this work. This is a tribute to its value of a practical kind, and one which probably brings more comfort (and that of a solid nature) to the author than any number of appreciative reviews. We have so recently reviewed the book that an extended notice is unnecessary. Our readers will find that in the present edition new matter has been added, and that the tables which are afforded contain reliable matter is vouched for by the fact that the author acknowledges his indebtedness to the classical authority—Tredgold, in one place, and in others we find the names of such practical persons as Kirkcaldy, Lister & Co., A. & J. Stewart, whilst continental knowledge has also been put under contribution. No single person could, of course, have compiled personally so vast a mass of information, but credit is due to the author for the descrimination he has shown in taking here, and rejecting there, the tables which are now so liberally showered upon the engineer. The book, as we have before indicated, is one likely to be of great practical value to the engineer and shipbuilder.

Electric Plant Special Marine Electric Light Number. 1893.

As is pointed out in the preface, the scope of this volume (for it is a quarto book of about 100 pages of text) is somewhat wider than its title would lead us to expect. It not only gives a very complete account of the systems and plant used for electric lighting at sea, but it also gives descriptions of the various other methods in which electricity is made to help the sailor in his manifold duties on shipboard, whether in the Royal or Mercantile Navies. Such inventions are noticed for example as that of Captain Lloyd, of Elswick, whose electric engine-room and steering telegraphs are illustrated. Electricity is examined in its application to torpedo and submarine mining purposes, and chapters are devoted to its development in the French and the United States Navies. In the chapter on the Mercantile Marine a large number of different types of dynamo are illustrated, and as an example of the present-day practice a detailed description of the installation on board the newest Orient liner, described in our own pages at the time of her coming out, is given. The application of the light to the duty of lighthouses, buoys, docks, and canals is also gone into, and even electric boring machines and electrically-driven fans for forced draught purposes. The book throughout is capitally illustrated, containing besides constant illustrations in the text, no less than ten double-page plates of vessels and places of interest in the present connection. Generally it may be considered to be a very true guide to the present position of electricity at sea.

Correspondence.

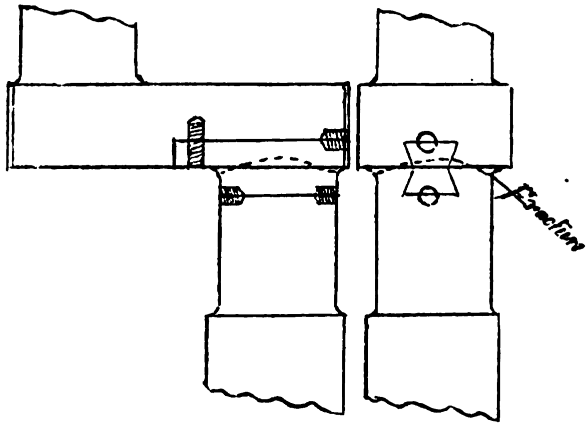
It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—Ed. M. E.]

BREAKDOWNS.

To the Editor of The Marine Engineer.

Dear Sir,—While reading the accounts of recent breakdowns, it has occurred to me that a case which happened in the year 1879 might prove of interest to your readers, the details of which are as follows:—

The steamer *Algean*, of Leith, when in the Indian Ocean, broke her crank shaft at the after end of No. 3 main bearing. A strong monsoon then blowing, which made it difficult to work, as the vessel was put under all sail with wind and sea abeam. The



shaft was, however, effectively repaired, as shown in sketch herewith, afterwards steaming half-speed against the monsoon to Point de Galle, a distance of 400 miles, and while there waiting until the full strength of the monsoon decreased, a new dovetail piece was fitted. The vessel then proceeded for Port Said, slowly at first, stopping occasionally to lift the top brass to see if all was right, gradually increasing the speed as confidence was gained, calling at Aden, where a general examination was made, and during the latter part of the Red Sea passage and through the Canal full speed was maintained. On arrival at Port Said a new shaft was waiting for her. Owing, I presume, to the modesty of the chief engineer, this was never made public. Apologising for troubling you,

I am, Sir, yours faithfully,

J. L. N. Y.

Miscellaneous.

The Niger.—The Naval Construction and Armaments Co., of Barrow-in-Furness, completed their contracts under the Naval Defence Act by the delivery to the dockyard authorities at Sheerness, last month, of the new first-class gunboat *Niger*, which has been built upon similar lines to the *Jason* and *Jaseur*, which were recently delivered from the same firm. The *Niger* has a displacement of 810 tons, and her engines have been designed to propel her at a speed of 19¼ knots under forced draught, and 17¾ knots under natural draught. The preliminary trial of the *Niger* in Morecambe Bay was attended with successful results, and her machinery worked satisfactorily on the voyage from Barrow to Sheerness, which was accomplished in 45 hours. The Admiralty have directed the *Niger* to be immediately prepared for commission at Sheerness dockyard. She is to be armed with two 4·7 in. and four 3-pounder quick-firing guns and five torpedo tubes.

The Ramillies, a first-class battleship of the *Royal Sovereign* type, which was recently received from the Clyde, where it was built and engined by Messrs. Thomson, made an eight hours' contractor's trial of her engines, at Portsmouth, on April 25th, under natural draught. The ship was designed for a mean load-draught of 27 ft. 6 in., and her mean immersion on trial was 25 ft. 2 in. The average steam in boilers was 149 lbs., which was maintained with the remarkably low air pressure of ·22 in. The vacuum was very good, averaging 27·8 in.; and the port and starboard engines were worked regularly at 96·7 revolutions. Under these conditions the engines developed 4,705 and 4,710 H.P. respectively, thereby securing a collective I.H.P. of 9,415 and a log speed of 16·75 knots. The designer's estimate was 9,000 H.P. and a 16 knot speed. The coal consumption during the run was 1·7 lb. per unit of H.P. per hour, which was much below the average.

Magnolia Metal.—Our readers will be interested in the following result of a practical test to which Magnolia metal was subjected at the Shipbuilding Works of Messrs. W. B. Thompson & Co., Limited, Dundee. The test in question was made in the footstep bearing of a grindstone, 5 ft. 10 in. diameter by 12 in. thick, spindle running in Magnolia metal, the engine making it revolve at 241 revolutions per minute. When at full speed the engine was stopped completely, but the stone continued to revolve for 70 minutes. The nearest result obtained by Messrs. Thompson from other metals tested under same conditions was 45 minutes. This proves the really anti-frictional nature of the Magnolia anti-friction metal in a very striking manner.

Delta White Anti-Friction Metal.—A new alloy under the above title is being introduced upon the market, by the Delta Metal Co., Limited, for use in bearings. We give below a copy of the results of tests made by Professor W. T. Unwin upon this new alloy. He states in his report that it works extremely well, and heats very little, even with high pressure on the bearing. It will be noticed from these results that the coefficient of friction is very low indeed, and that the temperature of the bearings is consequently very ow, even under the heaviest load, and at the higher speed—viv., 315 revolutions per minute.

Mean revs. per min.	Mean Press. per sq. in. of Journal surface in lbs.	Mean Temp. in °F.	Mean moment of Friction in lb. ins.	Nett pressure on one step lbs.	Friction on one step at Journal Surface lbs.	Coeff. of Friction.
123	128.35	62.65	9.25	477.5	6.17	0.01292
	256.70	64.00	16.26	955.	10.84	0.01185
	385.05	65.75	24.23	1432.5	16.15	0.01128
	513.40	67.70	40.87	1910.	27.25	0.01428
315	128.35	73.80	12.00	477.5	8 00	0.01675
	256.70	76.20	17.25	955.	11.50	0.01204
	385.05	80.05	26.00	1432.5	17.33	0.01210
	513.40	86.40	44.63	1910	29.75	0.01558

The Guion Line.—The march of improvement in mail steamers is causing the Atlantic companies to part with some old friends, which though no longer equal in speed to modern requirements have done the public and their owners excellent service in years past. We notice that on the 18th of May the Guion liner *Wisconsin* is to be put up for auction at Liverpool. She was built 23 years ago by Palmer's, of Jarrow, and has pursued a steady and uneventful career during which she has made upwards of 200 round voyages between the ports of Liverpool and New York. In our next issue we shall hope to give some further details of her history.

The P. & O. Co.—The Peninsular & Oriental Co. have contracted for a large new steamer of 7,500 tons and 11,000 H.P., for their India, China, and Australian mail services, with Messrs. Caird & Co., of Greenock.

The Manchester Ship Canal.—The Bill promoted by the Manchester Ship Canal Co. for the power to borrow £2,000.000 additional capital, and the Bill promoted by the Manchester Corporation to lend that sum to the company upon agreed terms, will both pass as unopposed Bills through the House of Commons, the threatened opposition to them having been withdrawn. These Bills have already been sanctioned by the House of Lords.

Cost of the Chicago Exhibition Buildings.—It is calculated that by the time the gates of Jackson Park are opened to visitors 20,000,000 dollars will have been expended by the management at Chicago on the buildings of the Exposition, the adornment of the grounds, foreign and domestic promotion, and the general administration of the fair. This sum, it is noted, does not include any of the amounts paid out by foreign countries for their buildings.

Fleurus.—On March 18th the torpedo cruiser *Fleurus*, for the French Navy, was launched at Cherbourg. The vessel, which is a kind of modified *Condor*, is 216 ft. long, 29 ft. 2 in. beam, and 15 ft. 6 in. deep, with a displacement of 1,300 tons. The vessel will be fitted with engines of 4,000 H.P., by which a speed of 18 knots is expected to be attained. The armament of the vessel will comprise five 10 cm. quick-firing guns, two 65 mm. quick-firing guns, and four torpedo tubes.

Barges for the Manchester Ship Canal.—The first of a fleet of flat-bottomed barges for use on the Manchester Ship Canal has been launched at the Canal Co.'s shipbuilding yard at Runcorn. The vessel is 60 ft. long, with a 14 ft. 2 in. beam, the ends being semi-circular and the sides almost perpendicular. The barge possesses great carrying capacity, and is fitted with apparatus for connecting a number of barges together, forming one long train. By this fleet of barges large ships, when necessary can be unloaded in the lower portion of the Ship Canal, and the cargo despatched expeditiously on to its destination even if on smaller canals, the barges being constructed to draw only 4 feet when loaded.

Screening of Ships' Side Lights.—Considerable correspondence has passed between representative shipowners and the President of the Board of Trade in reference to the Order in Council recently issued at the instance of the department, making new regulations affecting the screening of ships' side lights. It has been pointed out to Mr. Mundella that the order is based upon a miscalculation made during the deliberations of the Maritime Conference at Washington as to the normal convergence from the side lights, and that in crowded, narrow waters it is highly dangerous for the lights to be screened as directed in the order so as to secure 4 deg. of convergence. Although the order still remains in force, it is believed that the Board of Trade will be induced to modify its terms with the view of meeting the serious objections urged against the change which this introduced.

Messrs. Blackwood & Gordon, shipbuilders, engineers, and boilermakers, Port-Glasgow, are commencing to put down a slip beyond their present tidal basin at the east side of their yard, for the hauling up of vessels. They have acquired two acres of ground immediately adjoining their present property, so that the whole premises will be within one inclosure. On the slip, when complete, they will be able to lift a weight of 1,500 tons, the vessel having a draught of 10 ft. forward and 14 ft. aft. The length of the slip will be about 660 ft. As the slip will be close alongside Messrs. Blackwood & Gordon's engine shop and all the appliances of their yard, it will give very special facilities for the rapid and economical execution of repairs. The approach will be by the old channel of the river right up to the lower end of the slip, and by it vessels can come up at any state of the tide. The new venture will prove a great acquisition to Port-Glasgow and to the shipowners of the district.

Pleasure Barge for the Nizam of Hyderabad.—There has just been completed by Messrs. Messum, the well-known boatbuilders of Richmond, to the order of the Nizam of Hyderabad, a pleasure-boat peculiar in shape and for its size, exceedingly costly in construction. Two boats of the size of a large skiff have been joined side by side by a deck, upon the extremi-

ties of which rise a number of finely carved pillars supporting a pagoda-shaped roof. The whole of the woodwork is of teak, a wood which is not warped by heat. As an instance of the great expenditure of labour upon the boat, which is only 28 ft. long by 14 ft. wide, it may be stated that the tiles of the roof are composed of some 3,000 small pieces of teak, most of which have had to be specially cut. There are no windows, but all four sides of the barge will be hung with pure silk of the richest quality, while the deck will be cushioned in the same costly way to a height of some feet. The barge will be propelled by two feathered paddles, placed between the bows and sterns of the two supporting boats and turned by handles after the manner of a small canoe. The barge is intended for use on a lake near to which the Nizam has a summer palace. It is now moored in the river opposite to Buccleuch-house at Richmond.

Who was the first Marine Engineer ?—On the question of early steamers a correspondent writes that about a dozen years ago he learned some very interesting data from two well-known and much esteemed engineers, Messrs. William & John Hastie. The former, speaking of the *Industry* which was built in the year 1814, said it might be asked "Who was the first marine engineer ?" and to learn that fact it would be necessary to learn which was the first steamer employed in *trade*. He held that it was not the *Comet* in this country, nor the *Clermont* on the Hudson in America, but the *Charlotte Dundas*, which plied on the Forth and Clyde Canal at the end of last century towing barges, work which she did well, the only drawback being that the "wash" caused by her paddles, injured the banks of the canal. Mr. Hastie went on to say that the engineer of that steamer, and, therefore, the first marine engineer working a steamer, was Thomas Tosh, who was subsequently employed for many years by Messrs. Scott, Sinclair & Co., in the Greenock Foundry. When he became an old man, Mr. Robert Sinclair, who was then the locomotive superintendent of the Caledonian Railway, gave him an easy job at the company's works, which were then in Greenock. That pioneer marine engineer died in 1853, about eighty years of age.

Thule.—The new Swedish ironclad, the *Thule*, which is the largest Swedish warship of more modern type, has lately been launched at Finnboda, Sweden. She has a good many points in common with the *Svea* and the *Göta*, built at the Motala establishment, but is larger and has, what the others have not, a ram. The principal dimensions are:—Greatest length, 84·3 metres (281 ft.); length on the water line, 80 metres (267 ft.); greatest breadth, 14·6 metres (48¾ ft.); and the draught, full armament, is 4·9 metres (16 ft.); displacement, 3,165 tons. The space between the outer armour and the inner side of the vessel is divided into cells, 50 on each side, and 86 in the bottom, and the ship is, of course, divided into watertight compartments. The citadel is protected by armour varying in thickness between 296 and 197 millimetres. There are two turrets—one for manœuvring, and a somewhat smaller one for the heavier guns. This latter turret has a diameter of 7·076 metres (23 ft.); height, 1·86 metres (6 ft.), and can revolve 292 deg. It contains two Armstrong guns of 25·4 centimetres calibre, placed parallel with each other. The heavy armour plates for the turrets and sides have been delivered by Creusot. The engines, powder magazine, &c., are protected. Otherwise the armour plates are Swedish make from Domnarfolt. Inside the armour is a substantial coating of teak. The two propellers are worked by two compound engines of 3,200 I.H.P.. The normal speed is 15 knots, but it can be raised to 16 knots. The ram, of Bafors steel, weighs 10 tons without the heavy double armour. There are two movable mine tubes. In addition to the two guns mentioned there are four Bafors 15-centimetre guns, and five rapid-firing Maxim Nordenfelt 57-millimetre guns, which are placed on the upper deck, together with some Nordenfelt machine guns.

The Best Design for Main Bearings.—At the closing sessional meeting of the Manchester Association of Engineers, Mr. Daniels, the President, in the chair, an interesting discussion on the best design of main and other bearings was introduced by a paper read by Mr. A Saxon, in which he reviewed the general practice of the trade, and indicated the points to be considered in designing and constructing a main bearing. The four-step adjustable pedestal, when properly constructed, was, he considered, the best design for horizontal engines; as to lubrication, he was in favour of the pad system; whilst oil flats cut on the shafts, or spiral grooves, were found to be a considerable improvement for large bearings. In the discussion, Mr. Settle thought the four-step pedestal, though not without defects, worked fairly well, and the best method of lubrication was to put the oil on the top, and let it work in. The Chairman remarked that many people thought the present bearings were made too small, and Mr. Constantine quite endorsed this view, urging that numerous difficulties were traceable to this fact. Bath lubrication was good in locomotive and stationary engines where applicable, but was not often practicable. The Chairman said that special grooves in the necks were better than oil flats, and Mr. Settle urged that to make bearings larger would greatly increase the cost. Mr. Brown remarked that Magnolia metal had been tried at their works with great success. Mr. Nasmith said the majority of cases of over-heating arose from too small shafts, and to make them larger the extra cost would be very small. Mr. Settle remarked that a Manchester firm, well known for the moderate size of their shafts, had obtained better results than almost any other engineering firm. Mr. Saxon, in replying to the discussion, said it was not so much diameter as greater length of bearing that was most needed. As to roller bearings which had been mentioned, these had not been used much for engine work, but he certainly thought they would come into operation, as they would reduce the friction considerably.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from March 20th, 1893, to April 15th, 1893.

5893 J. Germain, L. Boisne, and H. Boisne. Asbestos steam packings.
5908 A. Turnbull. Steam boilers.
5934 C. J. Whitcher. Marine steam engine.
5958 H. E. Fouché. Distilling sea water.
5963 J. Marshall. Gauge cock for fixing to boiler.
5967 J. H. Brown. Water gauges for steam boilers.
5972 G. Price. Steamships.
5978 F. H. Rayer and C. R. Jeyes. Safety valves.
5985 A. B. Crowder. Smokeless boiler furnaces.
6022 C. H. de Tavernier. Ship propelling apparatus.
6077 W. Boagbrough and J. Hardcastle. Steam boiler furnaces.
6094 J. E. Slack. Indicating water level in boilers.
6185 R. Evans. Channelled bottom ship.
6292 H. G. Hudson, W. M. Rennie, and J. Graham. Smoke consumers.
6299 J. Murrie. Fuel economisers.
6349 H. Bown. Detaching gear for ships' boats.
6392 G. J. Wildridge and J. Murrie. Fuel economiser apparatus.
6418 G. Rider. Fuel economiser.
6466 C. C. Pötzsch and F. A. Schubert. Oars.
6507 R. W. B. Sanderson. Feed-water purifying apparatus.
6509 E. R. Billington. Ships' berths.
6510 E. R. Billington Ships' berths.
6515 E. Smith. Consumption of smoke.
6547 A. L. Hansen and W. Walker. Ventilators.
6550 D. Paterson and L. Percheron. Indicators for steam-boats.
6589 D. Donald and J. Sime. Ventilators.
6604 J. G. Williams. Feed-water heater.
6610 J. T. Turner. Fuel economisers for steam boilers.
6615 T. Marshall. Ships' propellers.
6630 J. S. Comrie. Indicators for use with torpedoes.
6704 J. Robinson. Ships' doors.
6711 J. P. Brooks. Raising ships above the water.
6721 G. Zahikian. Steam generators.
6760 J. Arnott. Ships.
6792 M. Hise and G. Hise. Steam generators.
6806 J. Barker. Steam boilers.
6808 A. McVicar. Tube plates of steam boilers.
6816 J. M. Walters. Indicating draught of ships.
6825 D. W. Vaughan. Raising sunken ships.
6826 G. W. Ray. Ventilators of ships.
6842 J. T. Wood and J. A. Brodie. Steam generators.
6872 W. Cutler. Propelling boats.
6928 A. Bère. Steam boilers.
6932 W. N. Cook. Non-conducting composition for covering boilers, &c.
7017 F. W. Golby. (P. Lodes, France.) Propelling vessels.

7043 G. H. Jones. Working torpedo net defence.
7072 W. K. Carew. Propelling small boats.
7076 J. Honeyman. Ventilators.
7078 G. F. Redfern. (W. McFarlane, Canada.) Ventilators.
7120 J. G. Calvert. Feed-water heaters.
7122 A. Hunnable. Safety of ships.
7129 D. Fletcher. Scrubbing apparatus for ships.
7170 A. W. Turner. (H. A. Stevens, U.S.A.) Life saving apparatus.
7208 E. T. Bousfield. Steam boilers.
7240 T. Andrews. Screw propellers.
7349 G. J. Buyskes. Cleaning ships' hulls when afloat.
7352 W. Syer. Raising sunken vessels.
7355 R. Baron and T. W. F. Knight. Fuel economisers.
7374 G. Rockliffe, J. Maughan, and W. Key. Construction of boats' davits.
7483 J. W. Goundry. Signalling ships at sea.
7513 S. Biosca. Steam generators.
7521 W. Crowther, A. Crowther, and F. Crowther. Smoke consuming appliances.
7534 G. Hough. Construction of vessels.
7549 J. Green. Signalling between ships.
7556 F. W. Webb. Marine boilers.
7587 F. Edwards. Construction of ships.
7611 W. M. Huskisson. Steering torpedoes.
7643 G. R. Steward. Feed-water heating apparatus.
7662 G. A. Haig. Propulsion of vessels.
7701 E. Harrison. Smoke consuming appliances.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1C, denotes First Class; 2C, Second Class.

March 1st, 1893.

Anderson, G. H. 2C Aberdeen
Atkinson, E. C. 1C L'pool
Batey, Robt. M. 1C N.Shields
Bertram, Hy... 2C London
Birss, William 2C Aberdeen
Bloomfield, Jas. 1C L'pool
Brooke, William 1C N.Shields
Brown, F. A. .. 1C Cardiff
Blue, James C. 2C Glasgow
Campbell, Angus 2C S'hmpt'n
Cheal, Jos. .... 1C Cardiff
Croft, F. G. .... 2C „
Denny, John .. 2C Glasgow
Dunn, William 2C Aberdeen
Dukes, George.. 1C Bristol
Fettes, Jos. .... 1C Dundee
Fletcher, J. T. R. 2C N.Shields
Gardner, Robert 2C L'pool
Grosvenor, A. T. 2C Bristol
Hall, Alex. C... 2C Aberdeen
Harris, David.. 2C Cardiff
Henderson, Jas. 2C Glasgow
Henderson, Jn. 1C Dundee
Hodgson, F. S. 2C N.Shields
Holt, Edward.. 1C L'pool
Hooker, George 2C London
Hoskins, George 2C Cardiff
Irwin, James .. 1C „
Jack, Alexander 2C Dundee
Lloyd, Edward 1C N.Shields
Low, P. M'N... 2C Glasgow
Macdonald, W. 2C N.Shields
Marshall, Joseph 2C „
M'Donald, W... 2C Aberdeen
M'Farlane, Jas. 1C Glasgow
M'Math, A. M. 2C Aberdeen
Moffat, H. W. 1C Glasgow
Page, Hy. .... 1C N.Shields
Paterson, H. C. 1C L'pool
Paterson, James 2C Glasgow
Ragg, R. F..... 2C N.Shields
Rait, John .... 2C Glasgow
Riach, James .. 2C Aberdeen
Russell, T. W. 1C N.Shields
Saville, George 2C L'pool
Sewell, Hy..... 1C N.Shields
Shepherd, W. F. 2C Cardiff
Shinn, Alex. R. 2C L'pool
Siddall, L. B. .. 2C London
Simonsen, C. H. 1C „
Smith, Alf. Jas. 2C Dundee
Soutar, James 2C „
Stocks, John 2C Cardiff
Thompson, G. W. 1C N.Shields
Towns, Emanl. 1C „
Tuckey, Fredk. 2C S'hmpt'n
Valentine, Hy. 2C N.Shields
Watson, J. M. 1C Glasgow
Wilson, David 1C London
Williams, David 2C Cardiff

March 25th, 1893.

Allen, Chas. H. 1C Cardiff
Barnes, Chas. H. 1C London
Bishop, Henry 2C Bristol
Bryce, Wm. A. 1C L'pool
Caverhill, J. G. 1C N.Shields
Chrystal Robt. 1C Glasgow
Clargo, Wm.... 1C London
Clark, Jno. .... 2C W.Hrtpl
Clough, Ernest 2C „
Crosby, V. de P. 1C Glasgow
Derrick, Walter 2C London
Drummond, R. 1C N.Shields
Fairley, Jno. .. 1C Glasgow
Hambling, J. W. 2C Cardiff
Harrison, Hy. S. 2C W.Hrtlpl
Hebden, Fk. B. 2C L'pool
Hill, Fredk. S. 2C „
Hoole, Jno. .... 2C N.Shields
Horton, George 2C L'pool
Hunt, Wm. F... 2C N.Shields
Inglis, T. M'F. 1C Glasgow
Jefferson, Josep. 2C W.Hrtlpl
Joyce, Francis.. 1C Cardiff
Kelly, C. C. .... 2C Glasgow
Kennedy, Jno... 1C „
Lawrence, G. C. 2C „
Logan, Jas. .... 1C „
Macalister, M'L 1C London
MacGill, Jno. .. 1C W.Hrtlpl
Mansfield, R. P. 2C L'pool
Meagher, Joseph 2C „
Muir, Peter .... 1C Glasgow
Petheran, G. H. 1C „
Rees, Mansel .. 2C Cardiff
Rogers, H. J. S. 2C „
Roope, S. B. .. 2C W Hrtlpl
Rowland, F. M. 2C N.Shields
Russell, R. E... 2C Hull
Sage, S. C. W. 1C London
Salmond, David 2C L'pool
Short, Thos. .. 2C N.Shields
Smith, James .. 2C „
Stanistreet, S. 1C L'pool
Thompson, F. W. 2C N.Shields
Waite, Thos. J. 2C W.Hrtlpl
Welch, Wm. .. 2C London
Whiteley, T. H. 2C Hull
Williamson, T. 2C London
Wilson, A. W... 2C N.Shields
Wilson Fredk... 1C „

April 1st, 1893.

Ainslie, Wm. .. 1C N.Shields
Bade, Carl .. 1C „
Bain, Hugh .. 1C „
Bain, James .. 2C Aberdeen
Broadbent, Hy. 2C N.Shields
Bunting, W. T. 2C „
Collins, F. D... 1C „
Davidson, F. C. 1C Aberdeen
Dunn, W. A. .. 2C Sundrlnd
Everall, John E. 1C Liverpool
Faulkner, W. G. 2C N.Shields
Galletly, J. W. 2C Liverpool
Gandy, M. H. 2C „
Gibson, W. H. 1C N.Shields
Hall, Robt. W. 1C „
Hodson, Fredk. 2C Liverpool
Jack, James .. 2C „
Jellie, Jno. .. 1C N.Shields
John, Thos. H. 1C London
Kenning, A. C. C. 2C Liverpool
Law, James .. 2C „
Low, Alex. .. 1C Aberdeen
Mansfield, G. W 2C London
Marsh, Rbt. W. 2C Liverpool
Martin, T. McD. 2C London
Maud, C. R. .. 1C „
May, Charles S. 2C „
McMillan, Jno. 2C „
Mousouris, P... 2C Liverpool
Pepper, G. S... 2C London
Reid, Robert .. 2C Aberdeen
Rewcastle, Rbt. 1C N.Shields
Saddler, Robert 1C London
Stenstrom, C... 2C Liverpool
Tosh, James R. 2C Aberdeen
Waddington, E. 2C Liverpool
Walker, Joseph 2C Aberdeen
Wickham, W.H. 1C London

April 8th, 1893.

Bertram, Alex. 2C Glasgow
Bovill, Joseph.. 2C N.Shields
Brown, M. .... 1C „
Bruce, Robert.. 1C London
Cockle, Fredk... 1C „
Denholm, James 2C Glasgow
Gardner, Jno... 2C N.Shields
Gates, Walter.. 1C „
Ginders, R.C.E. 2C Glasgow
Gracey, Jos. M. 1C N.Shields
Hamilton, R.W. 2C Cardiff
Hodder, Jno. .. 2C „
Jorgensen, T.M. 2C N.Shields
Lindsay, J. W. 2C „
Malcolm, R. W. 1C Glasgow
Martin, H. G... 2C N.Shields
Miller, Robt. N. 1C Glasgow
Mills, William.. 2C N.Shields
M'Ilroy, Hugh 2C „
Paton, James B. 2C Glasgow
Pill, Joseph.... 1C Cardiff
Shearman, T.W. 1C London
Stephens, Mark 1C Cardiff
Tod, David .... 1C Glasgow

April 15th, 1893.

Aldridge, G. .. 1C Greenock
Anderson, R. .. 2C Leith
Barr, Adam .. 1C „
Bartlett John.. 1C Greenock
Bicket, A. A. .. 2C Cardiff
Catterall, J. M. 2C Liverpool
Cooke, H. W... 2C „
Cornelius, H. G. 2C Cardiff
Evans, John J. 1C Liverpool
Frazer, John P. 2C Greenock
Haines, Walter 1C „
Hilling, Fredk. 1C Hull
Hodgson, Wm. 2C Liverpool
Jack, William.. 2C Leith
Kean, W. W. .. 1C Greenock
Kemp, T. H. .. 1C „
Lesley, William 2C Cardiff
Lessels, A.W.H. 2C Leith
Lindberg, F. .. 2C „
Lowe, James .. 2C „
Maccoun, Wm.E 2C N.Shields
Macintosh, Dvd. 1C Leith
Mackie, Wm... 2C Greenock
Macpherson, D. 2C „
McBride, Chas.. 1C „
McCance, Wm.. 2C Dublin
McDonald, D.. 1C Greenock
Milne, W. J. .. 1C Hull
Munro, Wm. .. 1C Dublin
Ross, Alexndr.. 2C Leith
Roy, John .. 2C Greenock
Sinclair, Alex... 1C „
Smail, Thomas 2C „
Walls, John .. 2C „

April 22nd, 1893.

Anderson, A.W. 1C London
Barnes, Wm. T. 2C „
Campbell, Geo.. 2C Liverpool
Carpenter, Fred. 2C London
Cloak, John .. 2C Dundee
Conrade, J. S. . 1C London
Curry, Jno. T. . 2C W. Hrtlpl
Denton, Herbt.. 2C London
Dunn, George. . 2C N.Shields
Evitt, Alex. .. 2C Glasgow
Fenwick, Fran. 2C N.Shields
Foxton, Chris. . 1C W. Hrtlpl
Fyffe, Peter .. 2C Dundee
Griffiths, E. M. 1C Liverpool
Hannah, T. R.. 1C Glasgow
Hoy, Wm. T... 1C W. Hrtlpl
Jobson, Hugh F. 1C N.Shields
Lowell, Jesse R. 1C W. Hrtlpl
Mackay, Jno. R. 1C Liverpool
Menzies, Geo... 1C W. Hrtlpl
M'Glashan, J.M. 2C „
M'Nab, John .. 2C Dundee
Mullineux, Ed.. 2C Liverpool
Paxton, John .. 2C W. Hrtlpl
Postgate, David 2C N.Shields
Rees, Griffith J. 2C London
Robinson, Geo.. 2C N.Shields
Ross, Donald .. 2C Glasgow
Roy, James E.. 2C Dundee
Smith, Edward. 2C N.Shields
Styan, Robt. W. 1C „
Summers, F. T. 2C W. Hrtlpl
Taylor, Geo. B. 1C Glasgow
Tritschler, Jos.. 1C W. Hrtlpl
Tully, Edwin.. 2C N.Shields
Waine, John T.. 2C Liverpool
Walker, Hugh.. 2C Glasgow
Wallace, Jas. .. 2C Dundee
Wilson, Wltr.S. 1C Glasgow
Wootton, Ed. G. 1C London

The Marine Engineer.

LONDON, JUNE 1, 1893.

THERE is little doubt that one of the chief risks to sea going steamers is the fracture of the propeller shaft. The serious accident to the *Umbria* which was so cleverly repaired by the engineering staff on board is still conspicuously in our memory. The system of twin engines and propellers is undoubtedly a proper and valuable guarantee against a complete break down of any steamer by the fracture of a propeller shaft; but this is only an indirect precaution against a possible evil to minimise its total effect and does not go to the root of the matter, to render propeller shafts safe from fracture. It is curious that so little has been done to endeavour to render the fracture of a propeller shaft less probable, though we believe some years ago one of our contemporaries illustrated a method of introducing an elastic clutch in the form of steel bars, which, it was claimed, would reduce the chance of fracture to a minimum. The arrangement was, however, cumbersome and far from neat, so we are scarcely surprised that it has not been adopted. In our opinion the suggestion in principle was a good one, that elasticity is the best remedy against fracture, where such fracture occurs under strains which at their maximum ought never to have a chance of breaking a shaft by direct torsional strain. We think the cause of fracture under strains, which are apparently quite inadequate to produce the result, may be put down to the fact that all fibrous metals tend to become crystalline under repeated shock and percussion and will then break under a strain much less than that which the material ought safely to bear under normal conditions. This fact is well known in railway axles which are annealed every five years to bring them back to their normal fibrous condition. We never heard of a propeller shaft being annealed every five years to prevent crystallisation. Assuming that it would be too difficult and expensive an operation to anneal propeller shafts, the next best remedy would be to deaden and reduce the percussion to which a propeller shaft is constantly subject, and this can probably best be done by making it torsionally elastic. Further, it is probable that propeller shafting from its rigid condition is subject to very severe bending and twisting strains by the hogging or even actual movement of a ship's hull by irregular expansion or when in a heavy sea, and this breaking tendency can only be counteracted by making the shaft laterally elastic. We have been much interested in the account of experiments carried on in New York, as to the employment of shafts made up of a bundle of steel wires. Here is at any rate an ideally elastic shaft if it has no corresponding drawbacks, for it would be elastic both torsionally and transversely, and still would be both compact and simple in construction. It will be remembered that steel wire is now being used for the construction of guns, and it has been proved that, weight for weight, the tensile strength of a bundle of steel wire is greater than that of ordinary wrought or cast metal. Thus it would appear that the actual normal strength of a steel wire shaft would also be greater, weight for weight, than a wrought or cast steel shaft, solid or hollow. The wires of each section are welded together at their ends, making solid masses of steel on which couplings are affixed, and forming, we suppose, smooth surfaces for the plummer block bearings. The shaft is thus made up in short sections. The spaces between the couplings are enclosed in short metal bands, holding the wires of each section in their normal cylindrical form, but permitting at the same time free elasticity of movement either torsionally or transversely. This should materially remove the jar and vibration of the propeller shaft in its effect upon the hull, and materially lessen the shock on the engines in a heavy sea, when the propeller is alternately lifted from the sea and suddenly immersed again. It is to be expected also that any tendency to deteriorate and eventually to fracture would be evidenced as in steel ropes by the parting of one or more strands, which would be plainly perceptible, and thus due notice would be given as to weakness before any possibility of ultimate fracture. We fancy steel wire shafting for propellers has a future before it, and we recommend the idea to our readers.

THE system recently introduced in England of running special express trains for the conveyance of passengers to and from the more important ocean liners at their ports of departure and arrival, is now so highly appreciated by travellers that it is regarded by them as an essential requirement for the economisation of time, as well as an important part of the superior, and in some instances, very luxurious accommodation afforded for long distance voyages. A strong and interesting inducement therefore exists for those railway companies who can most conveniently carry fast ocean steamer passengers to and from English ports of embarkation and landing: not only to follow this system, but to improve it as much as they reasonably can in relation to their own service of trains. Now no company has done so much for these objects as the London and North Western Railway Co. About four years ago, the company commenced a service of very fast trains, made up of excellent carriages, from Euston Station, London, to Liverpool,

for the conveyance of passengers from the latter city to the United States of America and Canada by the leading lines of steamships. These trains were run at a rather faster rate than the ordinary expresses of the company, and arrived in Liverpool within an hour of the starting of these steamers. During the present year the service of trains has been accelerated, and contains luncheon cars for first-class passengers, in which luncheons are served before the train reaches its destination. Luncheon baskets for these and other class passengers will also, if ordered, be handed in the train at Rugby. In other respects the carriages have been improved, so that without doubt the train is in every respect an excellent one. Six of these special trains were run in May up to the time of our going to press, and another is arranged to be run on the 31st. Some start from Euston Station at 10.55 a.m., and others at 11.30 a.m., and arrive at Lime Street Station, Liverpool, in about four hours and ten minutes, after stopping at Rugby for five minutes, and at Crewe for three minutes only. So much importance is attached to the punctuality of these trains that an absolutely clear road is required to be kept for them. The convenience of travellers is considerably enhanced by the system of checking their baggage at reasonable rates, both from Euston Station and the Town offices of the company, or from the hotel or residence of the passengers to Liverpool, delivered to the tender on which they embark from the landing stage or to the steamer on which they embark from dock. On arrival at Lime Street Station, Liverpool, passengers can soon afterwards reach this stage or dock either by cabs, or if having much baggage with them, by the small private omnibuses of the company. Passengers who wish to leave London as late as possible for America on their Liverpool route, can save one day by starting on the day of sailing from that port from Euston Station by the Irish mail train leaving at 8.20 p.m. with the American mails for Queenstown *viâ* Holyhead and Kingstown, arriving at Queenstown at 11.15 a.m., and where the steamer calls. Sleeping cars are attached to the Irish mail train to Holyhead, and through carriages are run from Kingstown to Queenstown. The London and North Western Railway Co. also frequently run special express trains from Liverpool to London for the conveyance of American passengers, and which generally arrive at Euston Station in a shorter time than their fastest ordinary "expresses." The company also frequently run a very fast special Postal train from Holyhead to London for the carriage of the American mails, in connection with a special train from Queenstown to Kingstown, and a special steamer from the latter port to Holyhead. A remarkable run was made by one of these trains from Holyhead to Euston, a distance of 263¾ miles, in 5 hours and 16 minutes. This was a much faster performance than any made by an ordinary Irish mail train, and may be regarded as a splendid indication of what may be done in the near future in connection with the important part taken by an English Railway Co. in the acceleration of the Transatlantic mail and passenger service. Lastly, we think it opportune to add that if the London and North Western Railway Co. continue to run the excellent service of special trains they now do in connection with the departure of Transatlantic liners from Liverpool, passengers from London to the Great Republic may generally rely upon reaching New York *viâ* Liverpool by the *Campania* and *Lucania* of the Cunard Line, and by the forthcoming faster steamers of the White Star Line, sooner than if they left London at the same time and proceeded from Southampton by the *Paris* or *New York* of the American, the *Fürst Bismarck* or *Normannia* of the Hamburgh-American, or by two of the fastest steamers, which are a little slower, of the North-German Lloyd's Line. It has been stated, on what we believe to be pretty good authority, that engines are about to be constructed whereby the journey between London and Liverpool will be reduced to four hours or less in favour of Transatlantic passengers.

THE struggle between Queenstown and Southampton, between the British service maintained by the Cunard and White Star Lines and the American Line, continues unabated. For the moment the advantage is strongly with Queenstown. The wonderful homeward passage of the *Campania*, beating the record by 2¼ hours on a course 80 miles longer than her predecessor's, was made against the *Paris*, which sailed a few minutes previously with the United States mail on board. The details of the *Campania's* voyage need not here be referred to save in so far as to note that the performance of 517 miles in a day's eastward steaming gives a hint of great possibilities in the future. But the arrival at this end of the journey claims our careful attention. In the first place she landed her passengers at Liverpool on the Friday night. This is in itself unprecedented. But in her mail transit she went almost beyond expectation. Owing to the exertion of the railway companies and the Cross Channel Steamboat people, her mails were delivered in the City on Saturday morning, and a whole working day was thus given before the outward mail was closed. This left Queenstown in due course on the Sunday. The *Etruria*, to whom it was entrusted, was telegraphed as reaching New York at 11 a.m. on the 20th. The course of post between London and

New York is thus reduced to fourteen days, and there is no reason why, when the *Lucania* comes on the scene, it should not be possible once every fortnight to get a reply from New York within two weeks of writing a letter in London. As luck would have it, the *Paris* did not reach Hurst Castle till half-past twelve on the Saturday, which made her passage about six days twenty-two hours mean time, and she consequently did not deliver her mails in London till the Monday morning. Thus in mail delivering the *Campania* took as much out of the *Paris* as the latter could do out of the *Gallia*, Cunard's third reserved boat. Twenty-four hours of this was, of course, due to the accident of Sunday's intervening. But if people adopt Saturday as a sailing day, they must take the risk of that. To add to the trouble at Southampton, the port itself did not come up to promise. We are told that the largest vessels can enter and leave the port any state of the tide. The *Paris* on this occasion tried to enter at dead low water, took the mud, and there was still further delay. The mud, of course, can be, and will be, dredged away, but meanwhile the old route is very much on the *qui vive.* The Mersey bar is daily diminishing, and the *Germanic's* mail came through from Queenstown to London in record time on the 18th to 19th May. Fourteen hours and a few minutes was all the time occupied on the journey, and doubtless it will be further reduced. Allowing one hour and a half between Southampton and London, that leaves 12½ hours on the overland journey in favour of Southampton. At 20 knots, that is equivalent to 250 nautical miles. But according to the admission of the Southampton people, Queenstown is it least 280 miles nearer New York than is Southampton. Some people would say it was more. But even that would leave an advantage of one and a half hours to Queenstown in respect of London mails. In respect of mails to nearly every other part of the country, the advantage is enormously greater. We cannot therefore believe that as long as the service is maintained with its present spirit, Queenstown is likely to be left behind.

The report of the Boiler Committee appointed by the Lords Commissioners of the Admiralty is before us, and contains a considerable amount of useful information and interesting facts, which may not be very novel, and are merely confirmatory of the views held by the best marine boiler constructors, but which at the same time are well worth attention as the results of very careful investigations of accomplished facts and tests. The important question of whether the present use of higher boiler pressure is advisable, and without serious disadvantages, is first considered, and we are glad to see that the whole Committee are unanimous in reporting that great economy has resulted from the use of the higher pressures and grades of expansion, and that there need be no accompanying risks of loss of safety or durability, when all details are properly designed and constructed, so as to be adaptable to such higher pressures. The Committee state that the evidence before them, chiefly obtained from the Mercantile Marine, show that there is an advantage of 20 per cent. in triple-expansion engines using steam of 150 lbs. pressure and above, as compared with bi-compound engines using 90 to 100 lbs. pressure, and about 25 per cent. advantage as compared with the older bi-compound engines using steam of 60 lbs. pressure. The Committee consider that the triple-expansion principle *per se* reduces vibration and the strains on the bearings and engine shafting, and thus makes a smoother working engine, and that experience has shown that the wear and tear with high pressures is generally no more than with low pressures, and in many cases it is less. The Committee do not think that the higher steam pressures in boilers has much in itself to do with the leaking of tubes, but that this leakage is primarily caused by pressing the boilers, either high or low pressure, to an undue evaporation, when the tube-plates and ends of tubes become overheated, with imperfect circulation. They press attention also on the rigid use of fresh water for boilers, without admixture of salt water, and that the auxiliary evaporating plant should be large enough to supply all demands of leakage, and that it should suffice for the production of a minimum of 6 tons of distilled water per day per 1,000 I.H.P. at the highest specified natural draught power, and that as a test in the manufacturer's works the evaporators should produce one-third more than that quantity. It is also recommended that the evaporators should be made in at least two or three parts, which could be worked "in series" for greater economy when the demand was not large. A considerable amount of attention has been given by the Committee to the fact that an increase in coal consumption per I.H.P. usually takes place in the Navy when the power required for service is at a minimum, and much below the maximum power that can be developed. They give several suggestions upon the point as to how an engine can be best designed to give high efficiency with low power. They do not approve of suggestions made to disconnect the low-pressure cylinder for this purpose, but first recommend that the engines should never be designed to give more than 5 per cent. beyond the specified full power with valves fully open and everything in full gear. They consider that in the past too great a margin has existed between the specified full power

and that which the engines are really capable of exerting. They also recommend that the slide valve, eccentrics, and gear, should be designed to give the natural draught power with the best distribution of steam in lead, admission, release, and cushioning, and the extra power beyond natural draught to be obtained by over linking or its equivalent, thus increasing the travel of the valve and securing a later cut off. As regards boilers, the Committee recommend 2·5 square feet of heating surface per I.H.P. at natural draught, and a grate area of 1-33rd the total heating surface. As to the arrangement of 2½ inch water tubes, they consider 1 inch apart in a vertical direction to be sufficient, but the horizontal distance to be not less than 1½ inches. On these points there appear to be dissentients, Mr. G. W. Manuel considering that there should be at least 1½ inch clear water space around all 2½ in. tubes, and Mr. W. Castle stating that recommendations of the General Committee as to boiler construction would reduce the maximum power of boilers in the *Latona* class from 9,000 to less than 7,000 I.H.P., which appears to him to be unnecessary. The Committee seem as a body to give their recommendation to steel as a material for shells, tube plates and tubes, though Mr. Manuel personally emphatically dissents from this and gives his adherence to the opinion that good iron tubes are the best. Both the Committee generally and Mr. Manuel individually, seem to think that there is a great opening for and advantages attached to tubulous boilers for high evaporation, especially with forced draught; but the Committee will not commit themselves on this point without special test and experiments. Mr. Manuel evidently thinks much greater power could be obtained by forced draught under special conditions than at present, and considers that the present practice under forced draught should be the minimum capacity.

Obituary.—As we go to press we much regret to hear from Birkenhead the death of Mr. H. H. Laird (Laird Brothers), fourth son of the late Mr. John Laird, M.P. He died at Claughton, Friday, May 26th, at the age of 55 years. Mr. Laird began his shipbuilding experience at La Ciotat, near Toulon, in the yard of the Messageries Imperiales (now Maritimes), where he remained about two years, returning in 1857 to the Birkenhead Ironworks. Having passed through the various stages of his profession he was admitted to be a partner in the firm. He has always held a high position as a designer. He had been a member of the Institute of Naval Architects since 1874, and was elected on the council of that body two or three years later, continuing to act in that capacity up to his death. He was also a member of the Institute of Mechanical Engineers. Mr. Laird was in London early the week before his death, with the Italian Attaché to meet the Italian Minister and Mr. W. H. White. He returned home on Thursday, May 18th, and on Friday presided at the meeting of the Birkenhead Science and Art Committee. On Monday he was seized with illness, which developed into pneumonia, from which he died. He leaves a widow, three sons, and a daughter.

NOTES ON SOME ALTERATIONS TO WHICH BOILERS ARE SUBJECT WHEN UNDER WORKING CONDITIONS.*

By T. J. Milton, Esq., Member of Council.

It is well known that boilers are subjected to alterations of form when under working conditions, due to the various parts being at different temperatures, the hotter portions expanding more than the colder parts; and very serious troubles have occasionally arisen from these causes, especially when they have been intensified by unskilful treatment, involving more than ordinary differences of temperature of the various parts of the boiler. It is not intended to allude to these in this paper, but attention is requested to certain alterations of form which may be of equal importance, and which result from variations of pressure alone. These are often of considerable extent, and it is singular that more attention has not been directed to them, seeing that they occur in every boiler, and that, as they must take place concurrently with the changes which are produced by differences of expansion, it may sometimes happen that difficulties which are attributed entirely to the latter may be, in part, at least, due to pressure as well.

In the tables given at the end of this paper, some deformations which take place are recorded. It will be noticed that where observations have been made at both working and test pressures the extent of the deflections appears in general to be in direct proportion to the pressure applied, being at the test pressure about twice that at the working pressure. In regard to these alterations of form it must be borne in mind that they in general do not appear to produce permanent set, even at the testing pressures. Also that while the fact that such deformations must take place in all boilers of similar design, of which many hundreds have been in successful use many years, shows that they are not of themselves dangerous, so long as the material of which the boilers are made is of good ductile quality, yet their extent indicates the necessity for using material for boilers possessing a very high degree of ductility, and for so designing the details of the construction that the inevitable deformations may take place without producing severe local strains.

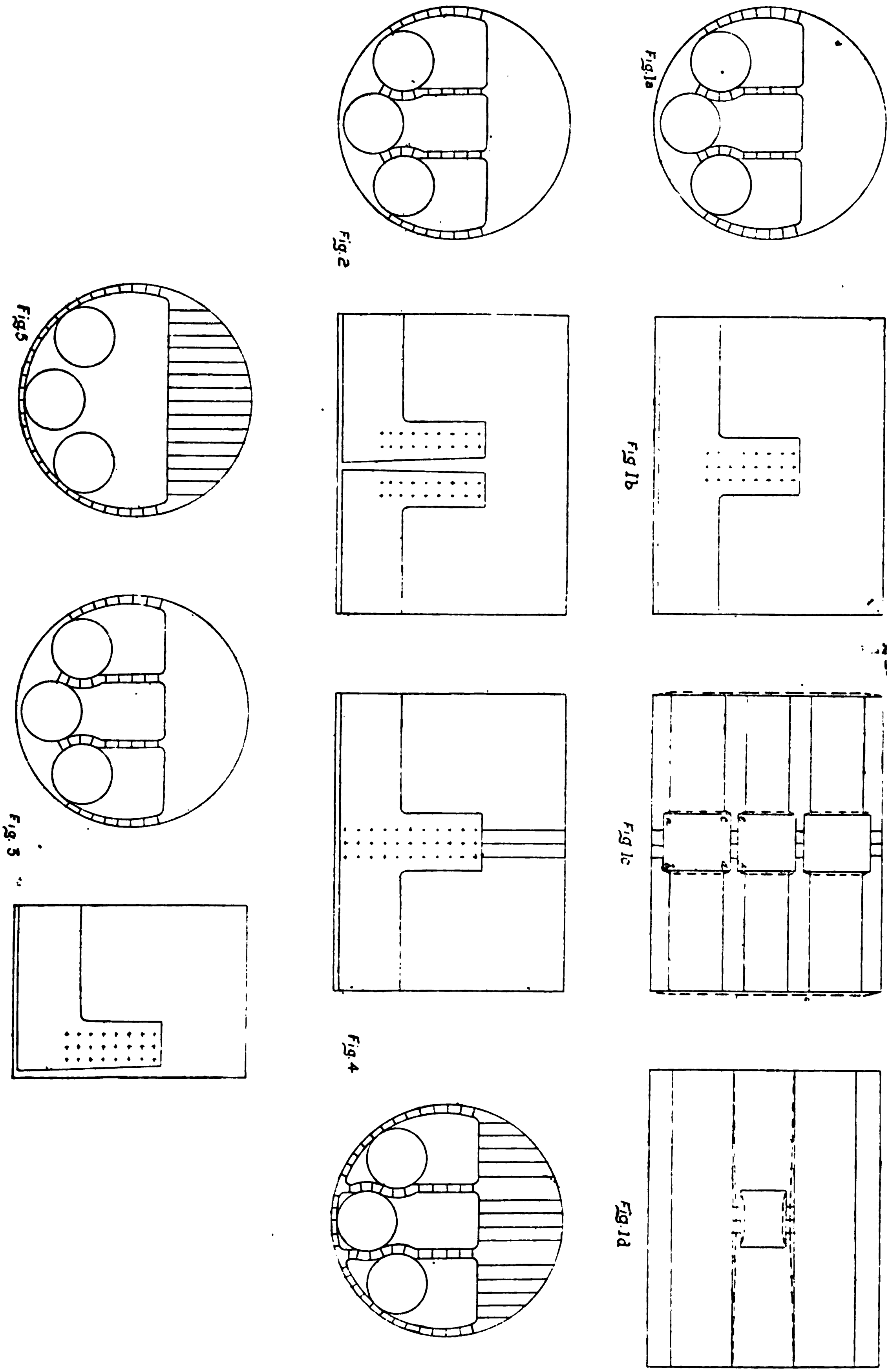
In designing boilers, the requirements of strength are generally supposed to be fully met by considering the cylindrical shell to be in perfect equilibrium under the uniform internal pressure, which produces a tensional stress in the shell plating proportional to the pressure and to the diameter of the boiler. The furnace flues are cylindrical in form, and, together with the cylindrical portions of the combustion chamber bottoms, are supposed to be in equilibrium under the uniform external pressure, and the compressive stress it produces in the plates; while the flat parts of the boiler are supposed to be perfectly supported by the stays.

In practice, however, there are several considerations which lead to departures from the simple conditions above alluded to, and it is in consequence of these that deformations of the different parts take place. The most important of these changes of form are the variations of the transverse dimensions of the combustion chambers, and the alteration of shape of the cylindrical shell.

Considering the latter first, it is evident at once that the cylindrical shell will be in equilibrium if it is truly circular in shape, and is subjected to a uniform internal pressure, but to no other forces. If, however, it is acted upon, in addition to the pressure by other forces not uniformly distributed round the circumference, the equilibrium will be destroyed, and an alteration from the truly cylindrical form must take place. In most boilers these latter conditions hold. The sides of the wing combustion chambers are stayed to the shell, as shown in Figs. 1 and 2; and, unless the staying is continuous round the crown and bottom of the boiler, as in Figs. 4 and 5, the pull of the stays must distort the boiler, lessening its horizontal, and increasing its vertical diameter. The alterations which actually take place in several boilers are recorded in Tables I. and II.

Next, consider the flat surfaces. If two equal surfaces be tied together by stays, and be subjected to equal pressures in opposite directions, they will be in equilibrium, and the stress in the stays may fairly be taken as equal to the total pressure

* Read at the Thirty-fourth Session of the Institute of Naval Architects March 23rd, 1893.



Notes on some Alterations to which Boilers are Subject when under Working Conditions. (See page 92.)

on either of the surfaces. If, however, unequal surfaces are stayed together, and are subjected to equal intensity of pressure, it is evident that—the load on the larger surface being greater than that on the smaller—the latter cannot produce supporting forces in the stays sufficient to prevent all yielding, and deformation will occur, the stays moving in the direction of the larger surface, which will bulge outwards, while the smaller surface will be drawn inwards against the pressure by the stays.

An illustration of this is shown in Fig. 1c, which represents the horizontal section of a double-ended boiler with six furnaces and three combustion chambers. The area of the front tube plate is greater than the combined areas of the three back tube plates. They are tied together by the tubes, and when under pressure the front tube plate bulges outwards, drawing the back tube plates with it, as shown exaggerated by the dotted lines. The deformation actually observed in these parts of several boilers are recorded in Table II.

Coming to the sides of the combustion chambers, we have those nearest to the shell plates connected to the shell by stays. The pressure on the chamber side plates would cause them to bulge inwards if there were no stays; the tendency to bulge

TABLE I.

	Boiler A.	Boiler B.	Boiler C.
Diameter of boiler (mean)	14 ft. 1 in.	15 ft.	15 ft. 8 in.
Length of boiler..	10 ft.	9 ft. 9 in.	17 ft.
Working and test pressures	160 lbs. 320 lbs.	80 lbs. 160 lbs.	160 lbs. 320 lbs.
Number and description of furnaces in boiler ..	three, Purves	three, plain	six, Fox
Diameter of furnace (outside)	3 ft. 3 in.	3 ft. 6 in.	3 ft. 11 in.
Length of furnace, over tube plates	7 ft.	6 ft. 6 in.	6 ft. 8 in.
Number of combustion chambers in boiler	three	three	three, each common to two furnaces
„ vertical rows of stays in sides of chambers	two	two	four
Thickness of shell plates	1⅛ in.	$\frac{11}{16}$ in.	1$\frac{11}{32}$ in.
„ chamber side plates	$\frac{19}{32}$ in.	½ in.	⅝ in.
„ chamber bottom plates ..	⅞ in.	½ in.	⅞ in.
„ furnace plates	$\frac{15}{32}$ in.	½ in.	$\frac{17}{32}$ in.
Chamber tops stayed by	girders	curved	girders
Chamber bottoms stayed by	not stayed	stiffened with ⊥, not connected to shell	not stayed

OBSERVED ALTERATIONS OF DIMENSIONS.

	Boiler A. At working pressure of 160 lbs.	Boiler A. At test pressure of 320 lbs.	Boiler B. At working pressure 80 lbs.	Boiler B. At test pressure of 160 lbs.	Boiler C. At working pressure 160 lbs.	Boiler C. At test pressure of 320 lbs.
	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
Decrease of horizontal diameter of shell	0	$\frac{1}{32}$	0	$\frac{1}{32}$	$\frac{1}{32}$	$\frac{11}{32}$
Increase of vertical diameter of shell	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{32}$	$\frac{3}{32}$	$\frac{3}{32}$	$\frac{1}{8}$
Decrease of width of centre combustion chamber at level of centre of boiler—						
Near back plate (boiler C near one tube plate)	$\frac{1}{32}$	$\frac{1}{16}$	0	$\frac{1}{16}$	$\frac{3}{32}$	$\frac{3}{32}$
At centre	0	$\frac{1}{32}$	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{3}{32}$	$\frac{3}{16}$
Near tube plate	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{3}{32}$	$\frac{1}{32}$	$\frac{1}{8}$
At narrowest part—						
Near back plate (boiler C near one tube plate)	$\frac{3}{32}$	$\frac{3}{32}$	$\frac{1}{16}$	$\frac{3}{32}$	$\frac{5}{32}$	$\frac{3}{16}$
At centre	$\frac{3}{32}$	$\frac{3}{16}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{32}$	$\frac{1}{8}$
Near tube plate	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{32}$	$\frac{3}{32}$	$\frac{1}{8}$	$\frac{3}{16}$
At springing of cylindrical part of bottom—						
Near back plate (boiler C near one tube plate)	0	$\frac{1}{32}$	0	0	$\frac{1}{8}$	$\frac{7}{32}$
At centre	$\frac{1}{32}$	$\frac{1}{16}$	0	$\frac{1}{32}$	$\frac{3}{32}$	$\frac{5}{32}$
Near tube plate	$\frac{1}{32}$	$\frac{3}{32}$	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{3}{32}$	$\frac{7}{32}$
Decrease of width of starboard chamber at level of centre of boiler—						
Near back plate (boiler C near one tube plate)	0	$\frac{1}{32}$	0	0	0	$\frac{1}{16}$
At centre	0	0	0	0	$\frac{1}{16}$	$\frac{3}{16}$
Near tube plate	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{32}$*	$\frac{1}{32}$	$\frac{3}{32}$
At springing of cylindrical part of bottom—						
Near back plate (boiler C near one tube plate)	0	0	0	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{1}{8}$
At centre	0	0	0	0	$\frac{1}{16}$	$\frac{1}{32}$
Near tube plate	0	0	0	$\frac{1}{32}$	$\frac{1}{16}$	[illegible]
Decrease of width of port chamber at level of centre of boiler—						
Near back plate (boiler C near one tube plate)	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{3}{32}$	$\frac{1}{32}$	$\frac{3}{32}$	$\frac{3}{32}$
At centre	0	$\frac{1}{32}$	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{3}{32}$	$\frac{3}{32}$
Near tube plate	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{1}{32}$	$\frac{1}{32}$
At springing of cylindrical part of bottom—						
Near back plate (boiler C near one tube plate)	$\frac{1}{32}$	$\frac{1}{32}$	0	0	0	$\frac{1}{32}$
At centre	0	0	$\frac{1}{16}$	$\frac{3}{32}$	$\frac{1}{32}$	$\frac{1}{16}$
Near tube plate	$\frac{1}{32}$	$\frac{3}{32}$	$\frac{1}{16}$	$\frac{3}{32}$	$\frac{1}{32}$	$\frac{1}{16}$

* This indicates a slight return movement.

produces a tension in the stays which, as we have seen, distorts the shell from a truly cylindrical form. This yielding of the shell must be accompanied by a yielding of the chamber sides, which accordingly become curved inwards.

If we now consider the chamber as a whole, we see that as the pressure on the side *a b* is exactly to that on the side *c d*, the total forces exerted by the stays on the side *c d* must also be equal to the total forces exerted by the stays on the side *a b*. The difference between the total pressure on either side and the forces exerted by the stays on that side must be borne by the tube plates *a c* and *b d*, which will be put into compression. The sides *e f* and *c d* must be under nearly the same condition of load and support as the side *a b*, and therefore their deformation, if any, under these conditions must practically be the same as that of *a b*, so that all three chambers will be nearly equally deformed. The stays in the water spaces are practically unaltered in length, so that the diminution of horizontal diameter of the shell will produce a collapse or narrowing of each of the chambers equal to about one-third of the alteration of diameter.

If we refer to Fig. 3, representing a single-ended boiler, it is seen that the position of the stays being near the back end plate, the deformation of the shell with an equal pull of the stays must necessarily be much less than in a double-ended boiler, and that

TABLE II.

	Boiler D.	Boiler E.	Boiler F.	Boiler G.	Boiler H.	Boiler I.	Boiler J.	Boiler K.	Boiler L.
Diameter of boiler (mean)	13 ft. 3 in.	12 ft. 9 in.	14 ft.	13 ft.	14 ft. 6 in.	14 ft. 8 in.	13 ft. 7 in.	13 ft.	12 ft. 6 in.
Length of boiler	10 ft.	16 ft. 7 in.	16 ft.	17 ft.	18 ft.	17 ft.	17 ft. 8 in.	16 ft.	17 ft.
Working and test pressures	150 lbs. 300 lbs.	160 lbs. 320 lbs.	160 lbs. 320 lbs.	180 lbs. 360 lbs.	150 lbs. 300 lbs.	175 lbs. 350 lbs.	160 lbs. 320 lbs.	160 lbs. 320 lbs.	180 lbs. 360 lbs.
No. and description of furnaces in boiler	3 plain	6 Fox	6 Fox	6 Purves	6 Purves.	6 Purves	6 Purves	4 Purves	4 plain, with Adamson rings
Diameter of furnace (outside)	3 ft.	3 ft. 3 in.	3 ft. 4½ in.	3 ft. 2½ in.	3 ft. 7 in.	3 ft. 6½ in.	3 ft. 4 in.	3 ft. 7 in.	3 ft. 7 in.
Length of furnace, over tube plates	6 ft. 7 in.	6 ft. 8 in.	6 ft. 2 in.	7 ft.	6 ft. 2 in.	6 ft. 11 in.	6 ft. 9 in.	6 ft. 4½ in.	6 ft. 10 in.
No. of combustion chambers in boiler	three	three, each common to two furnaces	three, each common to two furnaces	three, each common to two furnaces	six	three, each common to two furnaces	three, each common to two furnaces	two, each common to two furnaces	two, each common to two furnaces
No. of vertical rows of stays in sides of chambers	two	three	four	four	three	three	three	three	four
Thickness of shell plates	1¼ in.	1 3/32 in.	1¼ in.	....	1 3/32 in.	....	1 3/32 in.	1 3/32 in.	1 3/32 in.
" " chamber sides	7/16 in.	⅝ in.	⅝ in.	....	7/16 in.	11/16 in.	11/16 in.	⅝ in.	⅝ in.
" " " bottoms	⅝ in.	⅝ in.	11/16 in.	....	11/16 in.	⅝ in.	⅝ in.	11/16 in.	1¼ in.
" " furnaces	⅝ in.	7/16 in.	21/32 in.	....	11/16 in.	⅝ in.	21/32 in.	21/32 in.	⅝ in.
Chamber tops stayed by	girders	girders	girders, alternately suspended to shell	girders suspended to shell at centre of their length, and resting on tube plates at ends	curved, and gussets connecting opposite chambers	girders suspended as in boiler G.	girders	girders	girders
Chamber bottoms stayed by	not stayed	rest on brackets not secured to shell	brackets riveted to chambers and to shell	brackets riveted to chambers and to shell	stiffened by angles	⊥ bars and stays	not stayed	3 ⊥ bars	not stayed

OBSERVED ALTERATIONS OF DIMENSIONS.

	D: At Test Pressure of 300 lbs.	E: At Working Pressure 160 lbs.	E: At Test Pressure 320 lbs.	F: At Working Pressure 160 lbs.	F: At Test Pressure 320 lbs.	G: At Working Pressure 180 lbs.	G: At Test Pressure 360 lbs.	H: At Test Pressure of 300 lbs.	I: At Test Pressure of 350 lbs.	J: At Test Pressure of 320 lbs.	K: At Working Pressure 160 lbs.	K: At Test Pressure 320 lbs.	L: At Working Pressure 180 lbs.	L: At Test Pressure 360 lbs.
Decrease of horizontal diameter of shell	⅛ in.	⅛ in.	⅛ in.	....	⅜ in.	⅛ in.	13/16 in.	11/16 in.	....	....	1/16 in.	⅛ in.	⅛ in.	13/32 in.
Increase of vertical diameter of shell	⅛ in.	....	....	....	....	1/16 in.	3/16 in.	....	....	....	3/32 in.	3/32 in.	1/16 in.	11/32 in.
Decrease of width of centre combustion chamber at level of centre of boiler, at centre of chamber sides	3/32 in.	5/16 in.	3/32 in.	....	....	3/32 in.	3/32 in.	....	....	⅛ in.	....	....	....	....
Do. of width of side chamber at Do	1/16 in.	....	....	....	....	3/32 in.	5/32 in.	....	....	⅛ in.	....	⅛ in.	1/32 in.	3/32 in.
Do. of centre chamber at narrowest part (centre)	⅛ in.	1/16 in.	11/32 in.	1/16 in.	3/32 in.	....	....	....	11/32 in.	⅛ in.	....	....	....	....
Do. of centre chamber at narrowest part (near forward tube plate)	....	....	....	3/32 in.	3/32 in.	....	....	....	....	5/16 in.	....	....	....	....
Do. of centre chamber at narrowest part (near aft tube plate)	....	....	....	3/32 in.	5/32 in.	....	...	....	....	1/16 in.	....	....	....	....
Do. of centre chamber at springing of cylindrical part of bottom (centre)	0	3/32 in.	3/32 in.	1/16 in.	3/32 in.	....	....	....	1/32 in.	0	....	....	....	....
Do. of side chamber at springing of cylindrical part of bottom (centre)	....	....	....	....	....	....	....	....	....	⅛ in.	....	⅛ in.	....	....
Do. do. near fore tube plate	....	....	....	....	....	....	....	....	....	⅛ in.	....	....	....	....
Do. do. near aft tube plate	....	....	....	....	....	....	....	....	....	⅛ in.	....	....	....	....
Increase of length of combustion chamber, fore and aft, (back plate to tube plate or tube plate to tube plate)	3/32 in.	3/32 in.	3/32 in.	....	1/16 in.	1/16 in.	1/16 in.	3/32 in.	....	....	....	⅛ in.	....	1/16 in.

of the chamber will be less also. This is borne out by the figures given in Tables I. and II., in which boilers A, B, and D are single-ended, the others being double-ended.

It will be seen from these tables that the greatest alteration which takes place is in the horizontal width of the combustion chambers, at about the level of the centre of the wing furnaces. Fig. 1d shows a section of the boiler at this part. The wing chamber plates at about this level are parts of cylindrical surfaces, and if there were no stays fixed to them they would retain their form when the boiler was subjected to pressure. Evidently then, if, in addition to the pressure, they have forces acting on them produced by the pull of the stays, they must alter form, yielding in the direction of the pull, the case being similar to that of the shell plating acted on by the pull of the side stays. If any yielding takes place in this direction, the side plating of the centre chamber must become equally distorted, and the Tables I. and II. show that in some cases the narrowing of the centre chamber produced by this distortion is nearly a quarter of an inch at the working pressure, and as much as half an inch at the testing pressure. The yielding of the wing chamber side plating is, of course, of equal amount to that of the plating of the centre chamber; but, as it is outwards at this side, while the plating at the other side yields inwards, the width of the wing chambers at this part is not so much altered, and the straining action is, therefore, somewhat masked.

It is to be also noticed that in the side chambers, the plating being continuous at this part with the furnaces, the deformation referred to will take place without producing severe local stresses, but in the centre chamber at this level the tube plates prevent any yielding of the side plating adjacent to them, and it scarcely needs pointing out that the deformation, being of the extent above mentioned at the centre, and nearly as much at the end stays, but practically nothing at the tube plate ends, must put a severe local strain on the plates, especially if the staying is close to the tube-plate flange.

In two furnace-boilers, and in double-ended boilers with two furnaces at each end, the deformation of the shell is also found to take place, and in consequence the combustion chambers are also deformed; but there being no corresponding part to the narrowest part of the centre combustion chamber of three-furnace boilers, the maximum deflection is less.

The boilers noted so far have been constructed in the most common way, but attention should be directed to the methods of staying adopted by some engineers.

Fig. 4 represents a section of a boiler with combustion chambers of a peculiar shape. The sides and bottoms of the chambers are stayed to one another and to the shell, and the tops of the chambers are stayed by vertical stays to the upper part of the shell. It will be seen that this method of staying brings a nearly uniform loading throughout the whole of the circumference of the shell, and the staying across the water spaces between the chambers also avoids the difficulty pointed out in ordinarily made boilers. There should be practically no deformation in boilers made on this plan.

In other boilers a modification of this method is adopted, the pressure on the upper parts of the chambers being either in whole or in part supported by vertical stays secured to the shell of the boiler, and the bottoms of the chambers being also secured to to the shell either by stays or by brackets. When only part of the load on chamber tops is thus taken, as in boilers G and I, mentioned n Table II., it is seen that some deformation still takes place.

In conclusion, I should say that, for the very complete data given in Table I., I am indebted to my colleague, Mr. J. E. Stoddart, who made the numerous observations with great care, both under working pressure and test pressure, for the purpose of record in this paper.

For the other particulars, recorded in Table II., I am indebted to others of my colleagues who have at different times taken these particulars when testing boilers as matters of interest to themselves, without the least expectation of their being recorded in a paper. It is for this reason that they are not so complete as those given in Table I.

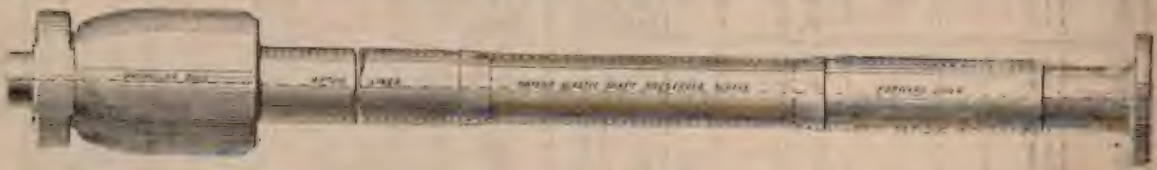
MUDD'S PATENT TAIL SHAFT PRESERVER.

THE rapid decay of tail shafts in steamers, and the enormous expense in the aggregate involved by the consequent renewal of the same, are subjects that have exercised the minds of a great many shipowners and engineers, and are matters of no small concern to underwriters.

It is generally conceded that a simple and reliable remedy, involving no radical change in existing practice and design, would prove a great boon to the shipowner and the underwriter, and would result, not only in the saving of a vast amount of capital, but of much privation and danger to those who go down to the sea in ships.

The question has been attacked from many points of view, but to the present nothing appears to have been done that can be generally accepted as a satisfactory solution of the difficulty. This is, probably, owing to most of the remedies proposed having a relation to only one phase of the trouble, and so not covering the whole ground.

A tail shaft is, perhaps, the most severely tried of all the parts of marine machinery. Its hardships are of a multifarious character. Those which consist of shocks due to the beating of the propeller on the water and to the passage of its blades past the stern post are not now under discussion, but only those which attack the material of the shaft. The first of



these is, doubtless, the galvanic action which arises immediately at the ends of the brass lines when immersed in water. The second is the general corrosive action that proceeds all along the middle part of the shaft between the liners when exposed to salt water in the stern tube, and which is aggravated by the churning action produced therein resulting in the water being largely mixed with atmospheric air.

We have the pleasure to illustrate herewith a very simple method that is being carried out by Mr. T. Mudd, at the Central Engine Works, West Hartlepool, for preventing both these causes from taking any effect upon the shaft. Mr. Mudd holds that the one great essential to be aimed at is keeping the water away from the shaft, and that if this can be done effectually the whole ground is at once cleared, because neither the corrosion nor the galvanic action can proceed at all without the presence of water. He is quite aware this idea is not new, as it has been attempted in several ways, such as by lengthening out the liners till they meet and there brazing them together, but he believes it has never been effectually accomplished, and the covering of a shaft with brass all over is a very expensive expedient.

Mudd's Patent Tail Shaft Preserver then consists simply of a tube or sleeve, made of first-class india-rubber or other elastic material, which tube is made of such dimensions as to cling tightly to the shaft over the whole length between the liners and for several

inches up the inclined liners at its ends. For this purpose the liners are lengthened out about six inches more than is usual, and gradually tapered away to accommodate the elastic sleeve. This gentle tapering of the liners has another good effect, as it gradually diminishes the strength of the liner and so overcomes the objection to a sudden change of the strength where the liner finishes, and which, doubtless, in many cases, aggravates the damage caused by galvanic action at that point. When the preserver is to be put on the shaft, the shaft is thoroughly cleaned bright, and coated with a suitable cement, and by means of a special apparatus of a simple character, the sleeve is drawn over the end of the shaft until it is in its place, where it becomes embedded firmly in the cement, clinging so tightly as to make the accession of water beneath it quite impossible. When desired, the ends may be lashed with copper wire, over wire gauze, and the lashings soldered together, but this appears to be an unnecessary precaution. If any should object that the sleeve is likely to become damaged by the shaft being pushed into its place in the tube, the answer is that this, too, has been carefully thought out, and a false nut provided which runs on the thread on the end of the shaft, the external diameter of which is precisely the same as the diameter of the brass liners, and which, therefore, holds up the point of the shaft as it passes through, preventing the elastic tube from being injured by the neck bush. This nut, of course, goes with the ship as part of the outfit.

As this scheme in no way interferes with existing design beyond requiring the lengthening of the liners, it is capable of application to all existing steamers when they are renewing or having new ends put on their tail shafts, and as it is a very inexpensive method of dealing with the question, as well as one that is likely to be a thoroughly practical and complete solution of the difficulty, it seems probable that it will soon be universally adopted, and regarded as just as ordinary a fitting as the lignum vitæ bush itself. The first vessel to be fitted was the s.s. *Aldworth*, a large steamer having triple engines, built at the Central Engine Works.

THE INTERNATIONAL NAVAL REVIEW AT NEW YORK AND OPENING OF THE CHICAGO EXHIBITION.

(*From our Special Correspondent.*)

At the invitation of the Hamburg-American Steamship Co., I proceeded to New York by the *Fürst Bismarck*, in time to be present at the International Naval Review and at the opening of the World's Columbian Exposition. The voyage from Southampton to New York was in every sense enjoyable, thanks to the very elaborate arrangements made by this company to ensure the comfort of passengers. The details of construction of the *Fürst Bismarck* were described at length in THE MARINE ENGINEER of June and July, 1891, in which numbers were also given illustrations of the engines, and several sectional views of the vessel, hence it is unnecessary to recapitulate here any of these particulars. I was, however, expressly invited by Captain Albers and Chief Engineer Jonas to inspect the machinery, and with the aid of the double-page illustration from THE MARINE ENGINEER of June, 1891, I was enabled to fully appreciate the many notable features in the most advantageous way. The twin-screws of the *Fürst Bismarck* were in the first place of steel, but the original screws have been substituted by others of manganese bronze, which is considered to be in some respects a more satisfactory metal for this purpose. The system of ventilation is I believe, as near perfection as we can expect to arrive. The engine and boiler rooms receive continuous supplies of fresh air from above by means of down-draught shafts provided with fans, so that the artificers and workmen employed in this department are subject practically to no unhealthy conditions. With regard to the passenger accommodation, those who have been accustomed to the close and incommodious berths in some of the older Transatlantic lines must indeed be agreeably surprised at the elegance and complete equipment of the sleeping and state rooms provided by the Hamburg-American line. The *cuisine* is also exceptionally good, and English travellers who start with any prejudice against German attendance soon find themselves quite mistaken.

Upon arrival at New York the International Naval Review and Military Parade was the event of the day. It was such an important function that it is of interest to enumerate the principal vessels taking part in the manœuvres.

The United States were represented by a fine array of cruisers and one fully-armoured coast defender. The *Philadelphia*, the flagship of the review fleet, is an unarmoured deck-protected cruiser of the second class, so rated because she has less than 5,000 and more than 3,000 tons displacement, according to the present method of rating ships in the United States Navy. Her high sides and her two pole masts without military tops are her distinguishing features. Like all the larger American ships, the *Charleston* excepted, she has two smoke pipes.

The dimensions of the *Philadelphia* are:—Length on water-line, 327 ft. 6 in.; beam, 48 ft. 6 in.; mean draught, 19 ft. 2 in.; displacement, 4,325 tons. The engines are triple-expansion, driving twin-screws; H.P., 8,814; mean speed six hours' trial at sea, 19·7 knots. Her main battery consists of twelve 6-in. breech-loading rifles; one is mounted on each side of the forecastle, one on each side of the poop, one light fours on each side, in sponsons, on the upper deck—so called, it being the next deck below the level of the poop and forecastle decks, which only runs part way from bow and stern. The secondary battery consists of four 6-pounder, four 3-pounder, and two 1-pounder rapid-fire guns and four Gatlings. The shields over the heavy guns are 2 in. thick, and the protective deck is 4 in. thick on the slope amidships over the machinery, and 2½ in. forward and aft. The total coal capacity is 1,150 tons. The *Philadelphia* is one of the so-called "19-knot cruisers" whose construction was authorized by Congress in March, 1887. Her keel was laid in 1888. She was launched in 1889 and was commissioned in 1890. Her present commander is Captain A. S. Barker.

The *Newark*, an unarmoured, deck protected cruiser, of 4,083 tons, is the flagship of the Rear Admiral second in command, Admiral Benham. The *Newark* is bark rigged like the *Chicago*, but she can be distinguished from the latter by her numerous projecting gun sponsons, the forward one and the after one of which are enormous. The *Newark* was laid down in 1888, launched in 1890 and commissioned in 1891. Her dimensions are:—Length on water line, 310 ft.; beam, 49 ft. 2 in.; mean draught, 18 ft. 9 in. Her engines are twin screw, triple-expansion; H.P. on trial (maximum), 9,231; maximum speed, 19·6 knots. Her total coal capacity is 850 tons, with a probable actual radius of action of about 5,000 miles; the theoretical radius is about 8,300 miles. Her main battery consists of twelve 6-in. breech-loading rifles, all mounted in sponsons on the upper deck; two are under the forecastle and two under the poop; eight are in broadside. The secondary battery is the same as that of the *Philadelphia*. The gun shields are 2 in. thick and the protective deck is 3 in. on the slope amidships and 2 in. forward and aft. Captain Silas Carcy commands her.

The *Chicago* is a second-class partially protected cruiser of 4,500 tons, her protective deck extending over the machinery only. She is bark-rigged. Aside from Admiral Walker's flag at the mizzen she will be distinguishable from most of the fleet by her rig and from the *Newark* by the arrangement of her battery. Her four 8-inch guns are mounted in large sponson ports under the forward and after bridges. The eight 6-in. and two 5-in. guns are mounted on the deck below; two of the 6-in. and both the 5-in. guns are in sponsons of peculiar type, resembling bulges or excrescences on the ship's side; the remaining six 6-in. guns are not mounted in sponsons, but fire through square ports of the old type. The secondary battery

consists of six 6-pounders, two 3-pounders, two 1-pounders and two Gatlings. The *Chicago* is one of the so-called "Roach cruisers." Her keel was laid in 1883, she was launched in 1886 and commissioned in 1889. Her dimensions are:—Length on water line, 325 ft.; beam, 48 ft. 2 in.; mean draught, 19 ft. The engines are twin-screw compound walking beam engines of a peculiar type. The H.P. on trial was 5,248; resulting speed, 16.3 knots. Her total coal capacity is 1,240 tons and her probable actual radius of action is about 5,000 miles. The protective deck is 1½ in. thick on the slope over the boilers and engines. Captain J. F. McGlensey is the *Chicago's* commander.

The *San Francisco* has exactly the same length, beam, draught, and displacement as the *Newark*, but there the similarity ends. The *San Francisco's* battery is a duplicate of that of the *Philadelphia* in character and arrangement. She was the other "19-knot cruiser," the *Philadelphia* being the first. The rig of the *San Francisco* consists only of two military masts carrying fighting tops. In this she resembles the *Baltimore*, but the latter has four 8-in. guns on poop and forecastle instead of four 6-in. and has only three sponsons on each side containing 6-in. guns instead of four, as in the *San Francisco*. The *San Francisco* has twin-screw triple-expansion engines; the maximum H.P. for one hour on trial was 10,400, speed 20·2 knots. Her total coal capacity is about 800 tons and her actual radius of action about 4,500 miles under ordinary conditions. Her commanding officer is Captain J. C. Watson.

The *Baltimore*, according to revised calculations, has a displacement of 4,600 tons at load draught, and is therefore the largest of the vessels of the new navy yet commissioned, though in ships of about the same displacement it is hardly accurate to say one is larger than the other, for there are constant changes of weights carried. When the *Baltimore* was first built she was put down as of 4,400 tons, but her load displacement has since been increased 200 tons. Her dimensions are precisely those of the *Philadelphia*, except the draught, which is 16 in. greater and accounts for the difference in tonnage. The *Baltimore* carries four 8-in. guns, one on each side of poop and forecastle, and six 6-in. guns, three on each side amidships. All these are in sponsons. The *Secretary* battery consists of eight 3 and 6-pounder rapid fire and ten machine guns. Her engines developed a maximum H.P. on trial of 10,725, the resulting speed being 20·6 knots. Her coal capacity is 1,140 tons and her radius of action is about 6,500 miles at a 10-knot speed. Her protective deck is 4 in. thick on the slopes amidships and the gun shields are 2 in. thick. Her present commanding officer is Captain G. W. Sumner.

The *Charleston* is almost a counterpart of the cruisers *Naniwa* and *Takachiho*, built by Sir William Armstrong & Co. for Japan. The plans were purchased by Secretary Whitney and the *Charleston* was built from them with some slight modifications. The *Charleston* and the Italian cruisers *Etna* and *Bausan* are almost precisely alike, aside from the difference in size. The *Charleston* carries two 8-in. guns instead of the 10-in. of the *Etna* and *Bausan*; the remainder of the battery, six 6-in. guns, is alike in all. The dimensions are:—Length on water line, 312 ft.; beam, 46 ft.; draught, 19 ft. 6 in.; displacement, 4,040 tons. Her maximum H.P. on trial for one hour was 6,943, speed 18·8 knots. Her coal supply is 800 tons and the steaming radius 5,000 miles, with fair quality of coal and tolerably favourable conditions. The *Charleston* was launched in 1888 and commissioned in 1889. Her present commanding officer is Captain H. F. Picking. The *Charleston* is readily distinguishable from the other American ships by her single large elliptical shaped smokestack.

The double-turreted monitor *Miantonomoh*, with her decks rising only 30 in. above the water, a high central superstructure with low, flat, white turrets at each end, could by no possibility be mistaken for any other ship in the review. The only armourclad wholly complete and in commission, for the *Monterey* has not yet received her turret armour. The hull of the *Miantonomoh* was begun in 1874 and completed, together with the engines, in 1880. From 1880 to 1888 practically nothing was done on her. In 1888 her turrets, which had been built in England, were received, and the work of completion was begun. Her four 10-in. guns were finished and installed during 1891, and she was placed in commission during the autumn of that year. She is frequently referred to as having been rebuilt or repaired, but as being otherwise identical with the *Miantonomoh* which went to Europe shortly after the war. This is a mistake. The only piece of the old *Miantonomoh* which is utilized on board the new is the ship's bell. The original *Miantonomoh*, moreover, had a wooden hull; the new one a hull of iron and steel. The dimensions of the *Miantonomoh* are:—Length on the water line, 259 ft. 6 in.; beam, 55 ft. 10 in.; draught, aft, 15 ft.: displacement, 3,990 tons. The H.P. of her engines is 1,800, and her maximum speed is 12 knots. Her battery consists of four 10-in. guns in two turrets—one forward and one aft. The secondary battery consists of two 6-pounders, two 3-pounders, and two 1-pounders. The armour on the turret is from 11·5 to 12·5 in. thick, compound iron and steel. The belt armour is 5 to 7 in. thick, of wrought iron. Her coal capacity is about 270 tons, and her radius of action is 1,800 miles. The present commanding officer of the *Miantonomoh* is Captain Montgomery Sicard, who was chief of the Bureau of Ordnance of the Navy for eight years during the whole inception and building up of the present system of ordnance in the navy.

The *Atlanta*, one of the four "Roach cruisers," is partially protected, having a protective deck over boilers and engines. She has a displacement of 3,189 tons. She was laid down in 1882 and commissioned in 1886. Her dimensions are:—Length on water line, 270 ft. 3 in.; beam, 42 ft.; draught, 17 ft. 6 in. Her battery consists of two 8-in. guns in low barbettes, 3 in. thick, one forward on the port bow and one aft on the starboard quarter. Between the barbettes is a high covered superstructure in which are mounted six 6-in. guns. The secondary battery consists of twelve rapid fire and machine guns. The H.P. of the engines is 4,000; speed, 16·4 knots. Her coal capacity is 580 tons, and her radius of action is about 4,000 miles at 10 knots. Her protective deck is 1·5 in. thick on the slope, and the gun shields are of the same thickness. The *Atlanta* is the only American vessel in the review fleet having a single screw. She is readily distinguishable from all others by her rig—two masts square rigged on both. Her smoke-pipes are two in number, high and raking with the masts. Captain J. F. Higginson is at present commander of the *Atlanta*.

The third-class cruisers *Yorktown*, *Bennington* and *Concord* are identical in all essential respects. The rig is that of a three-masted schooner, and there is but one smokepipe. The dimensions of these vessels are:—Length on water line, 230 ft.; beam, 36 ft.; mean draught, 14 ft.; displacement, 1,700 tons. The H.P. on trial ranged from 3,513 for the *Concord* to 3,660 for the *Yorktown*. The speeds were:—*Concord*, 17·1; *Yorktown*, 17·2; *Bennington*, 17·5 knots. The coal capacity is 400 tons, and the radius of action about 6,000 miles at 10 knots. The main battery consists of 6, 6-in. rifles, one on each side of the poop, one on each side of the forecastle, and one on each side in waist sponsons. The secondary battery consists of nine rapid fire and machine guns. The present commanding officers are:—Of the *Yorktown*, Commander Frank Wildes; of the *Concord*, Commander Edwin White; of the *Bennington*, Commander R. B. Bradford.

The *Vesuvius'* dimensions are:—Length on water line, 251 ft. 9 in.; beam, 26 ft. 5 in.; draught, 10 ft. 7 in. Her displacement is about 930 tons. Her main battery consists of 3 15-in. pneumatic guns; her secondary battery is three 3-pounder rapid-firing guns. The maximum H.P. shown on her trial was 4,450, and speed 21·7 knots. Her coal capacity is 150 tons; probable radius of action, about 4,500 knots. The *Vesuvius* is commanded by Lieutenant Seaton Schroeder. She can be readily distinguished by her long, low, narrow hull, the bow slightly higher than the central and after portions. Through this raised bow or forecastle the muzzles of the pneumatic guns protrude several feet, inclined at an angle of about 18 deg. There is but one smokepipe, which rises through the central house or superstructure.

The *Bancroft* was designed for a practice vessel for the naval cadets at Annapolis, for exercise during the academic year, and to carry one class on a practice cruise during the summer. She is in many respects a very perfect little vessel. Her dimensions are:—Length on water line, 187 ft. 6 in.; beam, 32 ft.; mean draught, 11 ft. 6 in.; displacement, 838 tons. Her speed on trial was 14·4 knots. Her coal capacity is 200 tons, and her radius of action is about 3,000 miles at 10 knots. Her main battery consists of 4 4-in. rapid-fire guns, mounted in sponsons on the upper deck, two each side. The secondary battery is seven rapid-fire and machine guns. The *Bancroft* was laid down in 1891, and commissioned March 3, 1893. She is commanded by Lieutenant-Commander Asa Walker. The distinguishing features of the *Bancroft* are her height out of water for so small a craft, and her rig, which is that of a barkentine.

The torpedo boat *Cushing*, commanded by Lieutenant F. F. Fletcher, will be the tender to the flagship *Philadelphia*. Her small size, dark greenish-coloured hull, raking smoke-stacks far apart, conical, round-topped conning towers forward and aft. and her turtle-back deck, are sufficient to distinguish her beyond any possible chance of mistake. The *Cushing's* dimensions are:—Length, 138 ft. 9 in.; beam, 14 ft. 10 in.; mean draught, 5 ft. 3 in.; displacement, 116 tons. Her H.P. on trial was 1·720, and her speed was 23 knots an hour. She has three torpedo tubes, and her battery consists of three 1-pounder rapid-firing guns. The *Cushing* has a small raking signal mast carrying a tiny yard.

The general appearance of the United States fleet made very favourable impressions upon representative naval officers from other countries, and Americans certainly have good reason to be proud of the rapid strides which have been made on their side during the past few years in the construction of war vessels. While, however, our Transatlantic cousins always have boasted of their capacity for keeping well in advance of the times, they are yet fully sensible of the fact that England maintains an almost impregnable position upon the seas and in all matters connected with marine engineering. As an instance of the under-current of thought which occasionally finds expression in the leading journals of the United States, we quote the following paragraph from a recent issue of the *New York Sun*:—

"In the construction of submarine cables and ocean steamships, our country is far behind England, which leads the world. At this time an American company is laying a cable from Peru to Central America, which was made in England. At this time two great ships for a new line between America and Australia are on the stocks in an English shipyard. The English made the new deep sea cable between South America and Africa. We recently bought our two best Atlantic steamships in England. It is England that owns most of the Atlantic cables, and owns a large proportion of the Atlantic steamships. By her cable lines on the beds of the world's seas, and her commercial marine on these seas, the power and wealth of England are immensely increased. *This country is wide-awake a part of the time, but England never sleeps.*"

The distinguishing features of the five vessels which composed the British fleet are well-known to many of our readers, but to enable comparisons to be easily made between our own ships and those of other nations, we recapitulate their leading features:—

The *Blake*, named after the celebrated admiral of that name, is the flagship of the British fleet on the North American station, and the largest vessel in the review. She is still carried on the British Navy List as an unarmoured cruiser, but as her curved armour or protective deck is 6 in. thick on the slopes over the boilers and engines, and as the upper parts of her cylinders are further protected by 5 in. sloping shields, it seems more just to class her with lightly armoured cruisers. Her protective armour by no means equals that of the *New York*, however, which has the same thickness of deck, carries her heavy guns in barbette turrets, and has a 5-in. vertical belt abreast of her machinery.

The *Blake* was designed to develop a speed of 22 knots, but the boilers being of a type that had in other vessels given way with fatal results when forced, it was considered too dangerous to attempt to use forced draught. The speed actually attained was 19·1 knots an hour, and she is probably capable of maintaining a 19 knot speed at sea continuously as long as the conditions are fairly favourable.

The dimensions of the *Blake* are as follows:—Length, 375 ft.; beam, 65 ft.; mean draught, 25 ft. 9 in.; displacement, 9,000 tons. Her battery consists of one 9·2 in. 22-ton guns on the upper deck forward, and one on the upper deck aft; ten 6-in. guns in sponsons, six on the upper deck amidships and four on the main deck beneath them. Her secondary battery consists of sixteen 3-pounder rapid-fire guns, seven machine guns, and two field-pieces. There are two submerged torpedo tubes, and two above water launching carriages. The two light masts of the *Blake* are for signal purposes only and do not carry military tops. She may be readily identified by the description given above and by the flag of Vice-Admiral J. O. Hopkins—a rectangular white flag with diagonal red cross—carried at the foremost head.

The *Australia* is one of a not very successful class of armoured cruisers begun in April, 1885. She was completed in 1888. The designed displacement was 5,000 tons, and when displacing this amount of water her 10-in. water line belt, 5½ ft. wide, should have extended 18 in. above water and 4 ft. below it. Her engines were increased in power from 7,500 to 8,500, and certain other weights were added to the battery and elsewhere. This increased the displacement 182 tons, and brought the upper edge of the belt down until it was only 11 in. above water. With all coal and stores on board, at a displacement of 5,750 tons, the top of the armour belt is more than a foot below the water line—not a very efficient protection. The *Australia* is readily distinguishable from the *Blake* and the other British ships. She is smaller than the *Blake*, and has two military masts with fighting tops and pole masts above them. Her main battery is precisely the same as the *Blake's*, and is similarly arranged except that all the 6 in. guns are in the superstructure on the upper deck. Only the forward and after pairs are in sponsons, the other six being mounted in recessed ports. The *Australia* cannot be confused with the vessels of any other navy—a glance at her national flag will be sufficient to prevent that. Her dimensions are:—Length, 300 ft.; beam, 56 ft.; mean draught, 22 ft. 6 in.; displacement (as per British Navy List), 5,600 tons. Her speed on trial over a measured mile was 18·8 knots, and her H.P. was 8.876. Her armour consists of the 10 in. belt mentioned above, 16 in. thwartship bulkheads at its ends, a 12 in. conning tower, a 3 in. protective deck at the ends, and a 2 in. armour deck over the belt. She has four torpedo tubes, all above water. Her total coal capacity is 900 tons, and her radius of action is about 5,000 miles. The secondary battery consists of six 6-pounder, ten 3-pounder, rapid fire guns, six machine guns, and two light field-pieces.

The third vessel of the British squadron in point of size is the *Magicienne*. She is an unarmoured deck-protected cruiser of 2,950 tons, with a hull of steel sheathed with wood and coppered. She is lightly rigged with two masts without yards. Her military tops on these are unusually low, being carried below the level of the top of the smoke-pipes, and not more than half-way from the rail to the lower mastheads. The battery is rather light, consisting of six 6 in. guns, one each side of poop and forecastle and one each side on the upper deck abreast the after smoke-pipe—all in sponsons. Her secondary battery consists of nine 6-pounder and one 3-pounder rapid fire, three machine guns, and one light field-piece. The *Magicienne* was designed for a speed of 19¾ knots, but after three unsuccessful trials finally made only 19·13 knots. Her estimated H.P. was 9,000; that actually attained on trial was 9,263, showing that it would require a H.P. of about 10,000 to reach the designed speed. The dimensions of the *Magicienne* are:—Length, 265 ft.; beam, 42 ft.; mean draught, 17 ft. 6 in. Her protective deck, extending from bow to stern, is 1·5 in. thick on the slope abreast the boilers and engines. Her conning tower is lightly armoured and the guns are protected by shields. Her coal capacity is 400 tons, and her probable actual radius of action about 5,000 miles under fairly favourable conditions. The *Magicienne* is readily distinguishable from the *Australia* by the difference in size, the arrangement of her battery, and the position of her military tops. A chart-house supporting the standard compass aft on the poop is a noticeable feature which gives an additional point of difference. The superstructure amidships on the *Australia* is wholly wanting in the *Magicienne*, which, on the contrary, has a depression there, her upper deck being uncovered between the poop and the forecastle.

The *Tartar* is a third-class cruiser of the *Archer* type, and is a sister ship of the unfortunate *Serpent*, which was recently wrecked on the coast of Spain with the loss of nearly every soul on board. This class of ships were the prototype of our own *Yorktown* class, which they resemble in many respects. The designed displacement was 1,630 tons, but additional weights have brought this up to 1,770 tons. Originally called torpedo cruisers, they were intended to be fitted with ten torpedo tubes. From causes not necessary to enumerate here the idea was abandoned and they are now fitted with three tubes, one fixed in the stem and two training tubes on the broadside. The rig of the *Tartar* is that of a barkentine, like the *Bancroft*. She has one smoke-pipe. Her main battery is exactly the same as that of the *Yorktown* class, both in character and arrangement. Her secondary battery consists of eight 3-pounder, two machine guns, and one other light piece of small calibre. Her dimensions are:—Length, 225 ft.; beam, 36 ft.; mean draught, 14 ft. 4 in. The H.P. of the engines on trial was 3,824 and her speed was 17·3 knots Her coal capacity is 325 tons, and her radius of action about 4,500 miles.

The *Partridge*, the smallest of the visiting British vessels, is a

composite (steel frames covered with wooden planking) gunboat of 755 tons. Her dimensions are:—Length, 165 ft.; beam, 30 ft.; mean draught, 11 ft. 4 in. She was launched in 1888 and completed the same year. Her battery consists of six 4-inch breech-loading guns and four machine guns. On trial her H.P. was 1,303 and the resulting speed was 13·8 knots. The *Partridge* is readily distinguishable from the other British vessels by her small size. Her coal supply is 105 tons, and her radius of action about 2,000 miles at 10 knots.

We now come to the French fleet. The *Arethuse*, the flagship of Admiral Librau, was here last fall, and took part in the Columbus celebration in October, where her high black sides, high masts fully square rigged and long projected ram bow, rendered her one of the most noticeable features of the naval parade. These features serve to distinguish her from all other ships in the parade, aside from her national colours and the Admirals' flag at the mizzen royal masthead. The *Arethuse*, and her sister ship, the *Dubourdieu*—the last French ship built wholly of wood—were launched in 1882. The battery is very numerous, consisting of four 6·3-in. guns in sponsons on the upper deck, two each side, and twenty-two 5·5-in. guns in broadside on the gun deck. Her secondary battery consists of eight machine guns. Her dimensions are:—Length, 277 ft. 6 in.; beam, 43 ft. 6 in.; mean draught, 21 ft. 9 in.; displacement, 3,400 tons. The *Arethuse* has a single screw, engines of 4,200 H.P., and a speed of 14 knots an hour.

The *Jean Bart*, the second of the French ships, is somewhat larger than the *Arethuse*, but this difference is not perhaps noticeable, except to the experienced eye. Her rig is totally different, however, consisting only of two military masts, each carrying two fighting tops. She has two smoke-pipes. Her dimensions:—Length on water line, 344 ft. 6 in.; beam, 43 ft. 6 in.; mean draught, 18 ft. 9 in.; displacement, 4,160 tons. Her battery consists of four 6·3-in. guns in sponsons, four 5·5-in. guns in sponsons, one 5·5-in. gun on the forecastle and one on the poop. Her secondary battery consists of sixteen rapid fire and machine guns. She has four torpedo tubes, one in the bow, one in the stern, and one on each side. Her protective deck is 3·55 in. thick on the slopes amidships. Her engines are twin-screw, of the usual type, and her boilers are Belleville tubulous. On trial her speed was 18·65 knots, with 7,846 H.P. The *Algie*, a sister ship, has made about a knot more.

The third of the French ships is the gunboat *Hussard*. Her rig is that of a bark. Last fall, it will be remembered, she accompanied the *Arethuse* in the Columbian naval parade. Like the latter she has a wooden hull. Her dimensions are:—Length, 201 ft. 10 in.; beam, 28 ft. 6 in.; extreme draught, 13 ft. 8 in.; displacement, 875 tons. Her battery consists of one 5·5-in. gun on the forecastle, one on the poop, and one on each side amidships. Her secondary battery includes a few machine guns. The *Hussard* was launched in 1875. Her speed on trial was 12·1 knots.

Germany was represented by two new ships. The flagship *Kaiserin Augusta* is a protected cruiser of the first class. She is fitted with two military masts carrying light signal yards and fighting tops. She has three smoke-stacks and a high bow, with a long projecting ram, and these features combined render her unmistakable aside from her national colours. Her dimensions are:—Length, 393 ft.; beam, 49 ft. 3 in.; draught 23 ft.; displacement, 6,052 tons. The German authorities stated that the speed attained was 22 knots, which seems very unlikely, unless the anticipated H.P. of the machinery, 12,000, was largely exceeded. Her battery consists of twelve 5·9-in. guns, eight 3·4-in. rapid-fire guns, and numerous smaller pieces. There are five torpedo tubes fitted, one in the stem, 13 ft. below water, and one launching tube on each bow and quarter.

The other German ship was the *Seeadler*, which has been completed within the past year. She is of composite build, steel and wood. Her dimensions are:—Length, 246 ft.; beam, 33 ft. 6 in., draught, 15 ft. 6 in.: displacement, 1,680 tons. Her battery consists of eight 4·14-in. rapid-fire guns, and four machine guns. She has two torpedo tubes The H.P. of the engines is about 1,600, and her speed is 16 knots.

The Russian ships were the *General Admiral* and the *Rynda*. The *General Admiral* is an armoured cruiser of 4,600 tons. Her belt armour is 7 ft. wide and 6 in. thick amidships, tapering toward the ends. In her main battery are six 8-in. guns, which are arranged in a square central citadel and which fire over a barbette enclosing the entire battery. This barbette citadel shield is 30 in. high and 6 in. thick. All her armour is of iron. Her dimensions are:—Length on water line, 285 ft.; beam, 49 ft. 3 in.; mean draught, 22 ft. The H.P. of her engines is 4,500, and her speed is 12 knots. The hull of the *General Admiral* is of iron sheathed with wood and coppered. She is full ship rigged and has one smoke-stack and a peculiar projecting stern.

The protected cruiser *Rynda* has a hull of steel sheathed with wood and coppered. She is full ship rigged. Her protective deck is 1·5 in. thick on the slopes amidships. Her guns have light shields. Her dimensions are:—Length on water line, 259 ft. 9 in.; beam, 45 ft. 11 in.; extreme draught, 18 ft. 9 in.; displacement, 2,965 tons. Her main battery consists of ten 6-in. guns, four on sponsons, two forward and two aft, and six in broadside amidships. Her secondary battery consists of twelve small pieces and machine guns. She has three torpedo tubes.

Three other Russian ships were expected to take part in the Review, but were delayed in arrival by the ice in the Baltic.

Italy was well represented by the *Etna*, the *Giovanni Bauzan*, and the *Dogali*.

The *Etna*, the largest of the Italian ships, is a protected cruiser of 3,600 tons. Her dimensions are:—Length, 282 ft.; beam, 42 ft. 7 in.; draught, 19 ft. 3 in. Her battery consists of two 10-in. guns, one forward and one aft, six 6-in. guns, in sponsons, three on each side in a central superstructure, and fifteen rapid fire and machine guns. She has two smoke-pipes and two military masts, carrying fighting tops. Her protective deck is 2 in. thick on the slopes. Her coal capacity is 600 tons She was completed in 1888. The *Etna*, the *Bauzan*, the *Charleston* the *Naniwa*, and the *Esmeralda* are all of the same type and the same general appearance.

The *Giovanni Bauzan* is almost an exact counterpart of the *Etna*. The only differences are that her protective deck is 1.5 in. Her dimensions are:—Length, 275 ft. 7 in.; beam, 42 ft. 7 in.; draught, 18 ft. 4 in. Her H.P. is 6,000, and her displacement is 3,250 tons.

The *Dogali* is a protected cruiser of a different type. Her dimensions are:—Length, 250 ft.; beam, 37 ft.; draught (mean), 14 ft. 6 in.; displacement, 2,150 tons. Her protective deck is 2 in. thick. Her battery consists of six 6-in. guns, two on the forecastle, two on the poop, and two in sponsons amidships. Her secondary battery is sixteen rapid fire and machine guns. She has two smoke-pipes and two military masts with revolving armoured tops. Her I.H.P. on trial was 7,600; speed 19·66 knots; coal capacity, 430 tons. She has four torpedo tubes.

The Netherlands was represented in the review by the *Van Speyk*. She is ship-rigged and has two smoke-pipes. Her hull is of iron, sheathed with wood and coppered. She was launched in 1888. Her battery consists of one 6·7-inch gun on a pivot forward, and one aft, and four of the same calibre in broadside; also eight 4·72-in. in broadside, and eight rapid fire and machine guns. Her H.P. on trial was 2,530, and her speed was 13·7 knots. Her coal capacity is 390 tons, radius of action about 2,500 miles at 10 knots. Her dimensions are:—Length on water line, 262 ft. 5 in.; beam, 39 ft. 4 in.; draught aft, 20 ft. 8 in.; displacement, 3,600 tons.

The Spanish flagship, the protected cruiser *Reina Regenta*, launched in 1887, was the most notable ship of the year. She was at least a knot faster than any cruiser that had preceded her, and was remarkable in other respects. In appearance, she is, from a side view, not unlike the *Charleston*. Her dimensions are:—Length on water line, 320 ft.; beam, 50 ft. 7 in.; mean draught, 20 ft. 4 in.; displacement, 5,000 tons. Her battery consists of four 9·45-in. guns, one on each side forward of the superstructure, and one on each side aft; six 4·72-in. guns in broadside, forward and after pair in sponsons, centre pair in recessed ports, and fourteen rapid fire and machine guns. She has five torpedo tubes. Her H.P. on trial was 11,500, and her speed was 20·07 knots. Her protective deck is 4¾ in. thick on the slopes; her conning tower 5 in., and her heavy gun shields 3 in. Her coal capacity is 1,150 tons, and her radius of action is about 7,000 miles at ten knots. She has two smoke-stacks and two military masts with armoured tops.

The *Infanta Ysabel* is a small cruiser of 1,150 tons, 1,600 H.P. and fifteen knots speed. She has a single screw and one smoke pipe, and is bark-rigged. The battery consists of one 4·72-in. gun on the forecastle, four in broadside on sponsons, and eleven rapid fire, machine, and small guns. Her dimensions are:—Length, 209 ft. 11 in.; beam, 31 ft. 11 in.; mean draught, 12 ft. 8 in. Her coal capacity is 213 tons. She has two torpedo

tubes. The *Infanta Ysabel* is the Spanish vessel that participated in the Columbian naval parade last October.

The *Nueva Espana* is a twin-screw torpedo gunboat of 570 tons, 2,600 H.P., and 20·5 knots speed. She has two screws and one smoke-pipe, and is rigged as a two-masted schooner. Her dimensions are:—Length, 190 ft.; beam, 23 ft.; draught, 10 ft. 4 in. Her battery consists of two 4·7-in. guns on sponsons amidships, four 6-pounder rapid fire and one machine gun. Two torpedo tubes are fitted. Her coal capacity is 106 tons.

The Argentine Republic is represented by the *Nueve de Julio*, a fast cruiser of 3,500 tons. The dimensions are:—Length between perpendiculars, 350 ft.; beam, 44 ft.; mean draught, 16 ft. 6 in. The battery consists entirely of rapid-fire guns—four 6-in., eight 4·7-in., twelve 3-pounders, and twelve 1-pounders. She has five torpedo tubes. Her protective deck is 4·5 in. thick on the slopes abreast the machinery, and 3·5 in. elsewhere. Her coal supply is 800 tons, and her radius of action about 7,000 miles. Her natural draught speed on trial was 21·94 knots, H.P. 10,300. No attempt was made to attain the maximum forced draught speed, but with a low air-pressure the speed reached was 22·74 knots, with 14,500 H.P. This speed could easily have been raised up to 23 knots.

Portugal was represented by the largest of her recent cruisers, the *Alfonso de Albuquerque*. This vessel is bark-rigged. Her dimensions are:—Length between perpendiculars, 205 ft.; beam, 33 ft. 2 in.; draught aft, 14 ft. She has a single screw; her engines are of 1,350 H.P., and her speed is 13 knots. Her battery consists of two 6-in. guns, one on each side, in sponsons; five 5-in. and three machine guns. Her coal capacity is 159 tons. The *Albuquerque* was launched in 1884.

Brazil was represented by the *Aquidaban*, the *Republica*, and the gunboat *Tiradentes*. The armoured turret-ship *Aquidaban* is a duplicate of the *Maine*, except in size. Her dimensions are.—Length, 280 ft.; beam, 52 ft.; draught, 18 ft.; displacement, 4,950 tons. She is ship-rigged as the *Maine* was originally designed to be. Her water-line belt is 11 in. thick, turrets 10 in., protective deck 2 to 3 in. Her main battery consists of nine 2-in. 20-ton guns and four 70-pounders. Her secondary battery is eighteen rapid-fire and machine guns. Her H.P. is 6,200, and her speed is 15·8 knots. The *Aquidaban* is of steel, sheathed with wood and coppered. The other ships named have already been noticed in recent numbers of the THE MARINE ENGINEER, and call for no special comment here.

It will be seen that the ships present practically included every class of war vessel, and that the entire fleet was certainly the largest ever brought together in any part of the world, affording the most valuable and interesting means of making comparisons between the several countries represented.

Travelling by the New York Central and Michigan Central Railroads, I arrived at Chicago in time for the opening of the Exhibition.

In consequence of the backward state of affairs at the Exhibition, it is impossible to give a detailed description of many of the exhibits at present.

Messrs. William Simons & Co., of Renfrew, occupy a conspicuous position in the British section, with models of their well-known hopper dredgers and elevating deck ferry steamers. Laird Bros., of Birkenhead, have a fine collection of ship models, as have also the Thames Ironworks and Shipbuilding Co. Limited, of London; the Cunard Steamship Co., Limited; the Atlantic Transport Line; Messrs. Donald Currie & Co.; Denny Bros., of Dumbarton; the Fairfield Shipbuilding and Engineering Co., of Glasgow and London; Messrs. Furness, Withy & Co., Limited, of West Hartlepool; Hawthorn, Leslie & Co., of Newcastle-on-Tyne; Armstrong, Mitchell & Co., Newcastle-on-Tyne; and Yarrow & Co, of London.

The White Star Line have a special building in the form of a kiosk in the grounds, containing models of steam and sailing ships.

Full details of these and other exhibits will be given as soon as the Exhibition is in a sufficiently forward state to admit of inspection.

"**Buenos Aires.**"—The steel screw steamer *Buenos Aires*, constructed by Messrs. Blohm & Voss, Hamburg, for the Hamburg and South American Steam Navigation Co., was recently taken for her trial trip with successful results, a speed of 11½ knots being attained. The vessel is 327 ft. long, and has a carrying capacity of 4,500 tons.

DENNY & GOURLAY'S PATENT LIGHT.

THE accompanying illustration shows a lamp recently patented by Messrs. Denny & Gourlay, of Leven Shipyard, Dumbarton, and which has already made its mark in the market. The lamp has been specially constructed to supply a safe, clean, and reliable light for sheds, workshops, and all open spaces without the danger of setting fire to its surroundings. From testimonials which the patentees have received, it has proved itself unequalled as a light for fishing boats when exposed to boisterous weather, and being exceedingly simple in construction and easily understood, providing a clean light by the vaporisation of clear naphtha or paraffin oil, it prevents the annoyance generally caused through the unconsumed oil scattering about. It can be easily converted into a heater, and as such saves much time and labour by heating both metal and irons at one time with surprising rapidity. As a heater, it has been extensively adopted by shipbuilding and engineering companies, gas and water corporations, plumbers, electricians, shipping companies, &c., and is highly recommended amongst other firms, by the Fairfield Shipbuilding and Engineering Co.; Messrs. John and James Thomson, Clydebank; Messrs. Wm. Denny and Brothers, Dumbarton; Messrs. Archibald MacMillan & Sons, Dumbarton; the Naval Construction and Armaments Co., Barrow, &c., &c. A feature of the lamp is the absence

of the necessity for costly appliances generally required for furnishing pressure, and its cheapness places it within the reach of every person requiring efficient and economical appliances of the kind.

The lamp is made in five sizes, from a tank capacity of one quart up to a capacity of four and a half gallons, but Messrs. Denny & Gourlay, from whom particulars may be obtained, have special designs to meet every conceivable requirement.

"**James Swift.**"—There was recently launched from the yard of Messrs. Davis & Sons, Kingston. Ont., the steamer *James Swift*, intended for the service between Kingston and Ottawa. Motive power is supplied by a set of compound engines by which a speed of 11 miles per hour is expected to be attained.

H.M.S. "CRESCENT."

THIS vessel is one of the first-class cruisers built at Portsmouth Dockyard, under the Naval Defence Act, from the designs of W. H. White, Esq., C.B., Director of Naval Construction. The principal dimensions are:—length, 360 ft.; breadth, 60 ft. 8 in.; displacement, 7,700 tons; mean draught, 24 ft. 6½ in.

The engines are built by Messrs. John Penn & Sons, Limited, Greenwich, and are designed for 12,000 I.H.P. forced draught, and 10,000 I.H.P. for natural draught, and are of the triple-expansion vertical twin-screw type, having cylinders 40 in., 59 in., and 88 in. diameter respectively. All with 51 in. stroke. The high-pressure cylinders are placed forward, and are fitted with piston valves, the inter. and low-pressure slide valves being of the double flat valve type, and fitted with Church's relief arrangement.

The cylinder covers, pistons and steam-chest doors are of cast steel. The cylinders are carried on cast-iron columns at the back, and round forged-steel columns at the front, the motion bars being attached to the back columns. The bed-plates are of cast steel strongly secured to bearers built in the ship. The piston and connecting rods are of Siemens-Martin Steel, the piston rods being fitted with combination metallic packing. The crankshafts are hollow, of forged steel in three separate pieces, the cranks being set at 120° apart. The surface condensers are made entirely of brass, the total cooling surface being 13,500 sq. ft. The circulating water is supplied by four 16-in. centrifugal pumps made by the engine contractors. The reversing gear is of the ordinary link-motion type, with solid bar links and adjustable working parts. Both steam and hand reversing gear are fitted. The air pumps are entirely of brass and are worked from the low-pressure piston rod crossheads; they deliver into a feed tank which overflows into the ship's fresh water reserve tanks. A Weir's evaporator and Normandy's distiller is fitted to each engine-room making together 180 gallons of fresh water per hour, while the evaporators above can supply 400 gallons per hour to the auxiliary condensers: these last named are two in number, and are made entirely of brass and fitted to condense the exhaust steam from all the auxiliary engines on board. There is a Weir's feed engine in each engine-room, and an auxiliary feed engine of Admiralty type in each boiler-room. Electric light machinery is supplied and fitted in each engine-room. Air compressing machinery is fitted in duplicate at each end of the vessel. Powerful boat-hoisting engines are supplied and fitted on the upper deck. The propeller shafting is hollow, of forged steel, 14¾ in. diameter in board, and 16 in. diameter outside the ship. The boilers are eight in number, of the marine return tube type, 16 ft. 1 in. mean diameter, and 9 ft. 3 in. long, each containing 4 of Fox's corrugated furnaces, 3 ft. 8 in. mean diameter; they are of Siemens-Martin steel throughout, and are designed for a working pressure of 155 lbs. per square in., and a proof pressure of 245 per square in. The heating surface is 25,248, and the grate 855 square ft. The main steam pipes are 14 in. diameter, and made of steel, while all copper pipes of 6 in. and over are wound with copper wire for greater security.

The preliminary trial of the machinery took place on the 16th ult., when after a satisfactory run, the vessel was prepared for her official eight hours' natural draught trial, which was most successfully carried out on the 18th ult. Mr. Oram attended on behalf of the Admiralty, and Mr. Rabbage represented the Dockyard, Mr. Wootton, chief inspector, the Steam Reserve, and Mr. J. P. Hall, the engine contractors. The I.H.P. developed was 10,370, with 98 revolutions of the engines, and without air pressure in the stokeholds, these being all wide open.

Only the natural draught trial was made, as it was determined by the Admiralty some months ago that the engines and boilers in this class of vessel (the first-class cruisers) should forego the forced draught trials, although they are better prepared to fulfil the conditions than some of the other vessels built under the Naval Defence Act, having very large boilers, and machinery of such dimensions that the full power, 12,000 I.H.P., might be maintained even with less than ½ in. air pressure.

The gun trials took place on Friday, 19th ult., after which, and on the same day the vessel was brought into the harbour, and preparations are now being made to complete the vessel for this year's manœuvres.

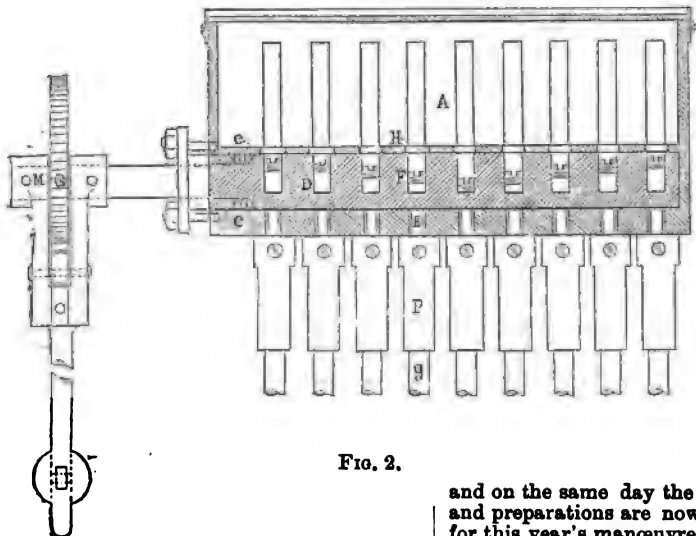


FIG. 2.

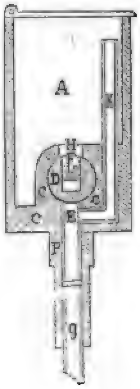


FIG. 3

ENGINE OIL-FEEDER.

MESSRS. A. T. Möller & Co., Copenhagen, are the manufacturers and patentees of the new patent oil-feeder which forms the subject of the annexed illustrations. It is to be noted that the feeder is not a lubricator in the usually accepted term of the word, but is only adapted for parts where pressure of supply is not required. It is suitable for oiling heavy and light bearings, guides, cranks, &c., in fact any part of an engine usually oiled from the boxes; and from the description which follows it will be seen that the advantages are very numerous. Fig. 1 shows an exterior view of a left-sided lubricator, and Figs. 2 and 3 are a longitudinal and cross section. In the solid bottom of the box C, figs. 2 and 3, revolves a cylindrical valve D, at the end of which is fitted a ratchet wheel and lever M G, which can be connected with any moving part of the engine. The valve D is arranged with a number of holes, receptacles for oil, which empty themselves into the outlet pipes when the valve is turned, thus allowing a uniform supply of oil to the

bearings. The screws F are adjustable so that the quantity of oil can be varied according to the requirements. The outlet pipes being connected with air tubes, will prevent the formation of vacuum, at the same time admitting of direct lubrication by hand if desired. The following are amongst the advantages claimed by the patentee and sustained by a large number of testimonials from, amongst others, the Imperial German Navy, the Royal Danish Navy, Nordeutsche Lloyd, &c., &c. :—1st. A great saving of oil, from 25 to 75 per cent. as compared with other methods. 2nd. In case of emergency oil can be brought to act directly upon the bearings without interfering with the lubricator's work, by pouring it through the air tubes. 3rd. Any kind of liquid oil can be used. 4th. The lubricator starts and stops automatically with the engine, thus preventing waste of oil and the bother of withdrawing or inserting the syphons. In conclusion we may say that the price of the lubricator places it on the market in competition with anything of the kind, and as far as we have been able to judge, it appears to have more than satisfied the expectations of any of the purchasers. Messrs. Möller are appointing agents at present in the chief ports of the United Kingdom, and we prophecy a large sale for this useful engine-room detail.

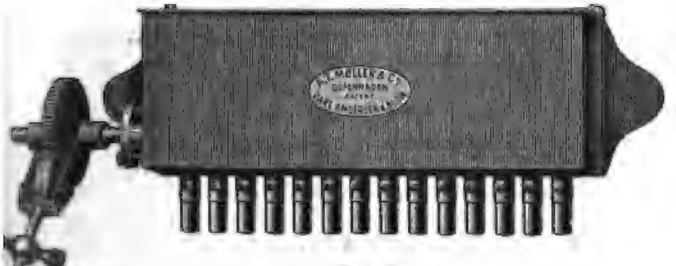


Fig. 1.

SKYE DIATOMITE.

ALTHOUGH it has been acknowledged for many years past that infusorial earth or "fossil meal" is very valuable as a nonconducting material for the coating of steam or other heated receptacles, not only by scientists of the highest standing, but by steam users as well, it has not been generally used, as its high price has militated largely against its being extensively adopted in this country. It has been pointed out by Dr. Hoffman, of Berlin, that its valuable qualities for the above purpose are almost incredible, and experiments have fully demonstrated its superiority over other substances.

This state of affairs, however, will now be considerably altered, by reason of the fact that large deposits of the mineral have been discovered in the Isle of Skye. The deposits, which are of a very fine quality, have been discovered in large quantities in Loch Quire. Samples have been analysed by Professor Macadam, of Edinburgh, who reports that "as sources of siliceous matter in a fine state of division and free from gritty particles of sand, I know of no deposit which is of equal value," and he adds, "I can confidently recommend these deposits as of first-class quality, and as more pure and free from noxious ingredients than any other deposit I have yet analysed from any part of the world."

One of the most important and remarkable characteristics of this diatomite is its lightness, which results in the fact that the weight per square foot is less than that of any other composition of the same thickness, and this, together with the fact that one inch thickness of diatomite equals, in non-conducting and heat resisting properties, about double the thickness of many non-conductors in the market, renders it especially suitable for boiler covering and cementing purposes.

The space occupied by it is therefore very small, and we understand that a coating of 1 in. in thickness has effected a saving of 80 per cent. of the heat lost in radiation by boilers and pipes uncovered. Some very interesting experiments have been made with diatomite and another well-known non-conductor upon two boiler tubes, by the superintendent engineer of the British India Steam Navigation Co., Limited, with the result that, whereas the water condensed in the tube covered by the latter composition in one hour was 14¾ in., that condensed in the diatomite covered tube was 9½ in. in the same time, which shows a saving of 36 per cent.

The product is being supplied by the Skye Diatomite, or Kieselguhr Co., for whom Messrs. John Waddell & Sons, of Greenwich Wharf, East Greenwich, S.E., act as agents.

The company are not boiler-coverers, but they have drawn up a series of recipes for making boiler covering compositions with diatomite as the basis, and there seems every reason to anticipate a well-merited popularity for this first-class fossil meal, which should undoubtedly effect a considerable saving to steam users if properly applied.

SOME MECHANICAL AND ELECTRICAL ANALOGIES.

By Dr. F. Bedell and Dr. A. C. Crehore.

NO phenomena are so readily comprehended as those which may be compared directly with facts that are familiar, and no reasoning is so quickly grasped as reasoning "by analogy." The analogies between certain mechanical and electrical relations are so striking that when either relations are understood the others follow, and from the laws of mechanics we can readily write those of electricity.

The process is a reversible one and the electrician can with equal ease step over into the realms of dynamics. To enable one to reason accurately in this manner and to reach definite results with absolute certainty, it is necessary to give with exactness the fundamental relations of mechanics and electricity. The following Tables are, therefore, given, showing the analogies between linear motion, motion of rotation and the electric current. Starting a current of electricity in a circuit is analagous to imparting motion to a body and requires an impressed force. This force must overcome the resistance (electrical resistance corresponding to that of friction) and the inertia of the mass or current.

In the case of the electric current this inertia is called "self-induction." A revolving fly-wheel may well represent the flow of electricity, its velocity corresponding to the current, its moment of inertia to the coefficient of self-induction and the friction to ohmic resistance.

Table I. Linear Motion.

Notation.

1. Time $= t$.
2. Distance $= s$.
3. Linear velocity $= v. = \frac{ds.}{dt.}$ $ds. = vdt$.
4. Linear acceleration $= a = \frac{dv.}{dt.} = \frac{d^2s.}{dt^2.}$
5. — Mass $= M$.
6. — Momentum $= MV$.

Frictional Resistance.

7. Frictional resistance $= R$.
8. Force to overcome resistance $= F_R = Rv$.
9. Energy expended in overcoming resistance in the time $dt. = dw_R = F_R\, ds. = Rv^2\, dt$.

Inertia.

10. Force to overcome inertia $= F^1 = Ma = M\frac{dv.}{dt.}$
11. Kinetic energy acquired in the time dt. $\Big\} = dw^1 = F^1\, ds = Mv.\frac{dv.}{dt.}\, dt.$
12. Kinetic energy $= W^1 = \int_0^v Mv.\frac{dv.}{dt.}\, dt. = \frac{1}{2}Mv^2$.

Inertia plus resistance—

13. Total force applied $= F = F_R + F^1 = Rv + M\frac{dv}{dt}$.

14. Total Energy supplied in the time $dt = dW = dWr + dW^1$ or $Fds = F_R ds + F^1 ds$; or $Fvdt = Rv^2 dt + Mv\frac{dv}{dt}dt$.

TABLE II. ROTARY MOTION.

Notation.

1. Time $= T$.
2. Angle $= \phi$
3. Angular velocity $W = \frac{d\phi}{dt}$ $\quad d\phi = wdt$.
4. Angular acceleration $= a = \frac{dw.}{dt.} = \frac{d^2\phi}{dt^2}$
5. Moment of inetia $= I$.
6. Angular momentum $= Iw$.

Frictional resistance.

7. Frictional resistance $= R$.
8. Torque to overcome resistance $= T_R = Rw$.
9. Energy expended in over-coming resistance in the time dt. $\Big\} = dw_R = T_R\, d\phi = Rw^2 dt$.

Inertia.

10. Torque to overcome Inertia $= T^1 = Ia = I\frac{dw.}{dt}$
11. Kinetic Energy acquired in the time dt. $\Big\} = dw^1 = T^1\, d\phi = Iw\frac{dw}{dt}dt$.
12. Kinetic Energy $= W^1 = \int_0^w Iw\frac{dw.}{dt.}dt = \frac{1}{2}Iw^2$

Inertia plus resistance.

13. Total torque applied $= T = T_R + T^1 = Rw + I\frac{dw.}{dt}$
14. Total energy supplied in the time $dt. = dw. = dw_R + dw^1$ or, $Td\phi = T_R d\phi + Td\phi$; or $Twdt = Rw^2 dt + Iw\frac{dw}{dt}dt$.

TABLE III. ELECTRIC CURRENT.

Notation.

1. Time $= T$.
2. Quantity $= q$.
3. Current $= i = \frac{dq.}{dt}$ $\quad dq = idt$.
4. Current acceleration $= B = \frac{di.}{dt}$
5. Coefficient of self-induction $= L$.
6. Electro-magnetic momentum $= Li$.

Ohmic resistance.

7. Ohmic resistance $= R$.
8. Electromotive force to overcome resistance $= e_R = Ri$.
9. Energy expended in overcoming resistance in the time dt. $\Big\} = Dw_R = e_R dq = Ri^2 dt$.

Self-induction.

10. Electromotive force to overcome self-induction. $\Big\} = e^1 = Lb. = L\frac{di.}{dt}$
11. Energy acquired by the magnetic field in the time dt. $\Big\} = dw^1 = e^1 dq = Li\frac{di}{dt}dt$.
12. Energy of Magnetic Field $= w^1 = \int_0^i Li\frac{di}{dt}dt = \frac{1}{2}Li^2$

Resistance plus self-induction.

13. Total electromotive force applied $= e = e_R = e^1 = Ri + L\frac{di.}{dt}$
14. Total energy supplied in the time $dt. = dW = dw_R + dW^1$; or, $edq = e_R dq + e^1 dq$; or, $eidt = Ri^2 dt + Li\frac{di}{dt}dt$.

A study of the tables will make these analogies more clear. It is to be noted that the fly-wheel or moving mass, in slowing down gives back its kinetic energy and the wheel is carried on, after the impressed force is removed, until this is entirely consumed in overcoming friction. Similarly, when the current diminishes upon the removal of the impressed electro-motive force, the energy stored in the magnetic field is restored to the circuit and the current keeps flowing until the energy is entirely used up in overcoming the ohmic resistance.

These analogies cannot be considered as rigorous proof. The truth of the relations here given for the electric current has been fully established and may be found in the introductory chapter to our work on Alternating Currents by the above authors. Other striking analogies will suggest themselves, but space will not permit calling attention to any but the most fundamental ones given above.

Physical Laboratory, Cornell University.
Jan. 16, 1893.

OPEN HOLLOW-SPINDLE CAPSTAN LATHE.

In order to keep pace in manufacturing with the present heavy competition and low range of prices it is necessary for engineers to study all points of economy in production, however small in detail they may appear to be. One of the greatest items in which modern ingenuity has effected large economy is in the production of various kinds of studs, pins, screws, &c., which are now made very cheaply with unskilled labour from the solid, by open hollow-spindle capstan lathes, instead of by the old method of forging, centering, and turning between centres.

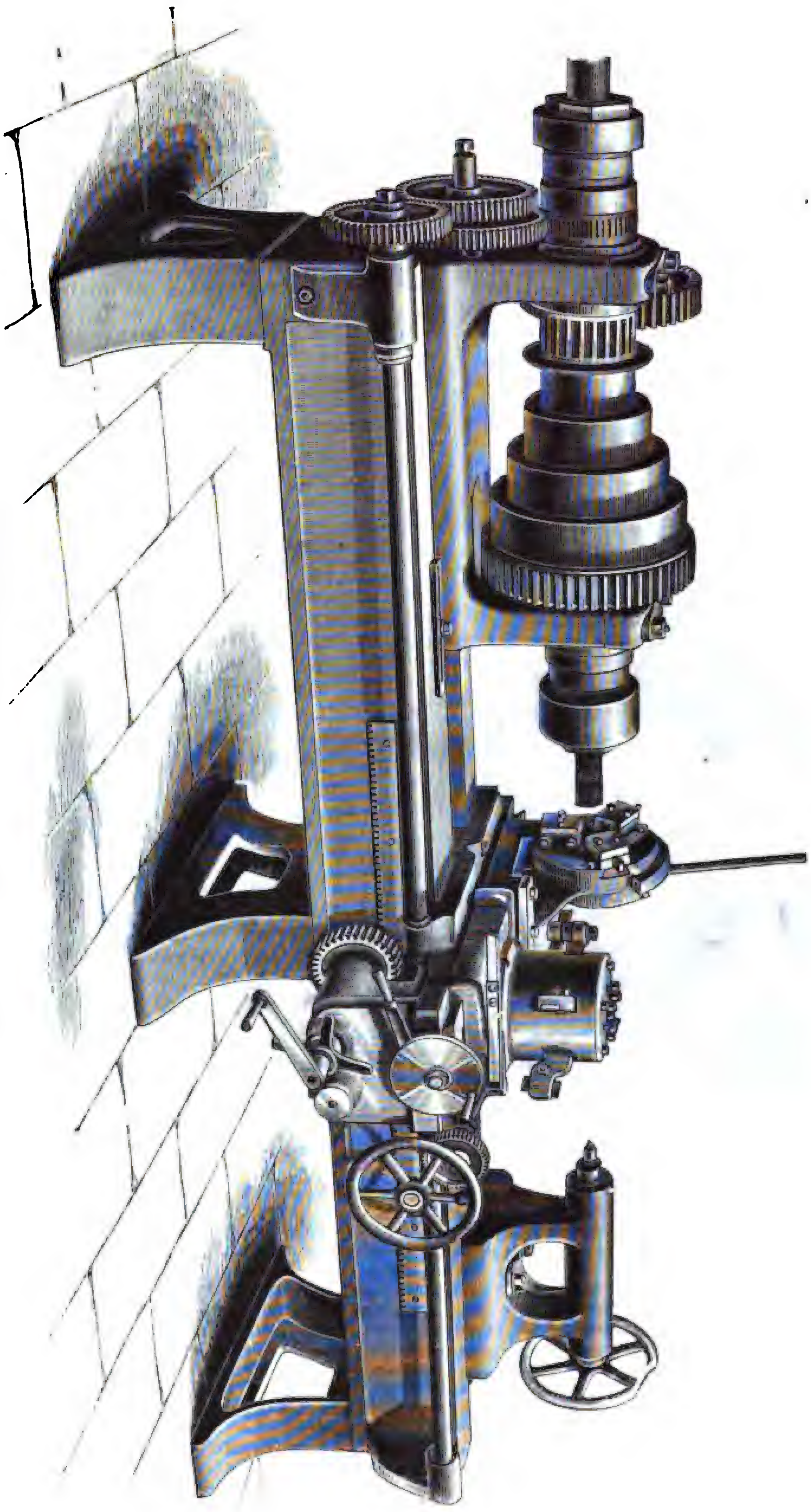
Of these capstan lathes one of the most complete and neatest that we have seen is that made by Messrs. James Spencer & Co., of Chamber Iron Works, Hollinwood, Manchester, illustrated herewith. It is a 12 in. centre lathe, weighing 74 cwts., with a bed 12 ft. long, and will admit bars up to 4 in. in diameter of any length right through the spindle.

The head stock is double-geared, and a bottom is cast in the bed forming a trough.

The fast headstock spindle is of steel, and may be open at the sides to take the heads of bolts, whilst they are being turned at the points, and the spindle runs in parallel gun-metal bearings, and has a cone chuck and holders in the nose for gripping different sizes of bars quite truly.

The screwing head is fitted with changeable dies to cut any desired thread upon the ends of the bolts before they are cut off, and is worked by the same screw as the capstan rest, with a fixed stop against which it may be brought so as to be in an exactly central position for screwing. When not in use, it can be run over to the back of the slide, and disengaged from the screw by a lever in front of the carriage. It has also a graduated index and movable stop, so that any number of screws can be made of exactly the same diameter. An adjustable stop is also provided for regulating the thickness of bolt heads, nuts, collars, &c., and the carriage may be locked on the bed when the rest is used for surfacing.

In the cap are fixed five tool-holders, holding the requisite tools for the different turning, cutting, and parting operations. It is now well recognized that much economy in time is derived by the use of tools particularly shaped to suit their special operations, and that by placing these various tools in a capstan head, so that they may be thrown in and out in succession without shifting the tools from their fixed position on the rest, it makes all the difference in time and good work, especially in the hands of a comparatively unskilled tool hand. The use of cutting tools held in holders as supplied with this machine is now generally being adopted, as it prevents the running backwards and forwards to the grindstone to set the tools, and the small tools being ground accurately in



OPEN HOLLOW-SPINDLE CAPSTAN REST LATHE. (*See page 104.*)

holders, cut much better and are more perfect than the old system.

With loose headstock and Clement's driver this lathe can be used as an ordinary sliding lathe for turning and chasing between centres as well as for overhanging work.

The tools made by this firm are well-known for their excellent quality and accuracy of finish.

FLOATING OF THE STRANDED STEAMER "ITHFAEN."

We have much pleasure in placing before our readers a short account of the floating of the new screw steamer *Ithfaen*, which stranded on the north-west corner of Lady Isle, three miles to the seaward of Troon Harbour, while on her maiden voyage from the Clyde to Liverpool. The *Ithfaen* is a steel screw steamer, 160 ft. in length, launched on the 21st October last by Messrs. Scott & Co., of Bowling, and intended for the coasting trade.

Our illustration shows the position of the vessel at low water, the rocks on which the vessel lay being of the most rugged description, her starboard side was literally punctured from end to end, whilst there was a hole in the engine-room that could have admitted a railway truck. The engines being situated aft, the holds, from the machinery to the bow, presented more than sufficient capacity to carry the whole vessel, with the engine-room and the stern full of water. As the bottom and port sides were little damaged, it was decided to float the vessel on her broadside as she lay, rather than upright her and add to her damage. After the whole of the ceiling had been cut away by the divers, and boxes fitted and bolted over the broken plates and frames, about 80 tons of stone ballast was placed inside close to the peak bulkhead for leverage, while two pontoons were attached on each side of the stern for steadiment. The hatches and other deck openings into the holds being closed, two steam pumps erected on the vessel's broadside easily commanded the water in the holds.

The *Ithfaen* was then towed on to the beach at Troon, stern foremost on her broadside, and by slipping the pontoon at her keel by a process of diverting the bulk of the stone ballast, she was

brought to an upright position the same tide, the steam pumps being kept at work pumping vertically until she was upright. The wounds in the engine-room and after end were then closed, and the vessel towed into the graving dock, where she is now being repaired. The whole operation of floating this vessel was a work of interesting ingenuity, and reflects great credit on the East Coast Salvage Co., Limited, and their superintendent, Mr. T. Napier Armit, who has more than once been described as the Napoleon of salvage engineers.

The above company, whose headquarters are at Leith, are certainly entitled to take a first place in such work, and it is only necessary to mention that since 1869, Mr. Armit has conducted the raising

of 64 vessels, including the ill-fated *Utopia*, sunk in 1891 off Gibraltar. His latest achievement is the floating, off Holy Island, of the s.s. *Ashdene*, described as likely to become a total loss. This work he accomplished two days after his arrival at the Island.

THE FIRST-CLASS TORPEDO GUNBOAT "ALARM."

THE trials of the first-class torpedo gunboat *Alarm*, the second of three vessels of this class constructed under the Naval Defence Act, from the designs of W. H. White, Esq., C.B., Director of Naval Construction, and built at Sheerness Dockyard and engined by Messrs. John Penn & Sons, Limited, were most successfully carried out at the beginning of last month.

The first of these vessels, the *Circe*, was tried some two months since, and the third ship, the *Leda* is now fast approaching completion.

The official eight hours' natural draught trial of the *Alarm* took place off Sheerness, on the 1st May, the mean I.H.P. developed being 2,593, and the maximum 2,819, as against the specified contract power of 2,500. The average I.H.P. for the first five hours was 2,750, but during the last three it was reduced to bring the mean down to about the contract. These powers were obtained with a mean air pressure in stokeholds of ·8 of an inch, the contract allowing one inch.

The forced draught full power trial of three hours, during which the machinery is required to develop and maintain 3,500 I.H.P. with not more than 3 in. of air pressure, was made with great success on Wednesday, the 3rd of May, the engines indicating a mean of 3,884 H.P. with an average steam pressure in boilers of 148 lbs., vacuum 27·5, revolutions 262½. The mean air pressure in stokeholds was 2·17, and the speed of the vessel 19·6.

On examination of the boilers after the trials there was no evidence whatever of any ill effects from the application of the forced draught.

The following shows the powers for the six half hours as taken:—

Half hours.	Stard.	Port.	Total I.H.P.
1	1924·1	1958·8	3882·9
2	1913·5	2054·2	3967·7
3	1909·4	2014·3	3923·7
4	1923·0	1956·9	3879·9
5	1830·4	1923·2	3753·6
6	1921·5	1975·0	3896·5

Mean I.H.P. for the three hours, 3,884.

At the above trials, Mr. Oram attended on behalf of the Admiralty, Mr. Moon representing the Steam Reserve, and Mr. Pattison the Dockyard. Mr. J. P. Hall represented the engineer contractors.

IMPROVED SLOTTING MACHINE.

THERE are few machine tools that are more generally useful for ordinary work than the vertical slotting machine, and the advance in the construction of machine tools is well illustrated by an improved slotting machine, built by Messrs. James Spencer & Co., of Chamber Iron Works, Hollinwood, Manchester, which we have pleasure in bringing to the notice of our readers. It will be noticed from the adjoining illustration of the machine, that it is a strong, substantial and very superior tool, having all the details according to the most approved practice. It is driven by a single gearing in the proportion of 6 to 1. The driving cone for the belt has four speed drums, each 3½ in. wide, the largest size being 20 in. diameter; a flywheel 30 in. diameter is keyed to the same shaft as the cone pulley. The ram slide has a continuous bearing, and can be raised or lowered by a screw and hand wheel arrangement, placed in front of the ram, so as to be within easy reach of the workman. The stroke disc revolves in a recess in the main casting, and provision is made for taking up the wear by an adjustable die. The driving crank stud in the stroke disc is made adjustable by screw, and the face of the disc is graduated to facilitate the alteration of the stroke to any desired length. The space between two of the arms of the driving wheel is fitted in with a weight to counteract to some extent the weight of the ram. The machine is arranged with a quick return motion, consisting of a slotted link pivotted to the frame, and a slide block working in the same and upon the crank pin. This increases the effective work of the machine by about 30 per cent.

The table is 27 in. in diameter, and is self-acting in all its motions, the feeding devices being variable and independent of one another. The table is provided with an adjustable canting motion, so that the requisite taper can be given to the key grooves. A lever and clutch motion is arranged so that the feed catchers for transverse and circular motion, always put on the cut at the top of the stroke, and whilst the tool is clear of its work. The machine illustrated has a stroke 12 in. in length, and will admit work 4 ft. in diameter and 18 in. in height. The traverse of table slides is 18 in. in a longitudinal direction, and 17 in. in a transverse direction, and the approximate weight is 70 cwt. A set of case-hardened wrought-iron spanners is supplied with the machine, and also overhead driving apparatus.

NAVAL MATTERS PAST AND PROSPECTIVE.

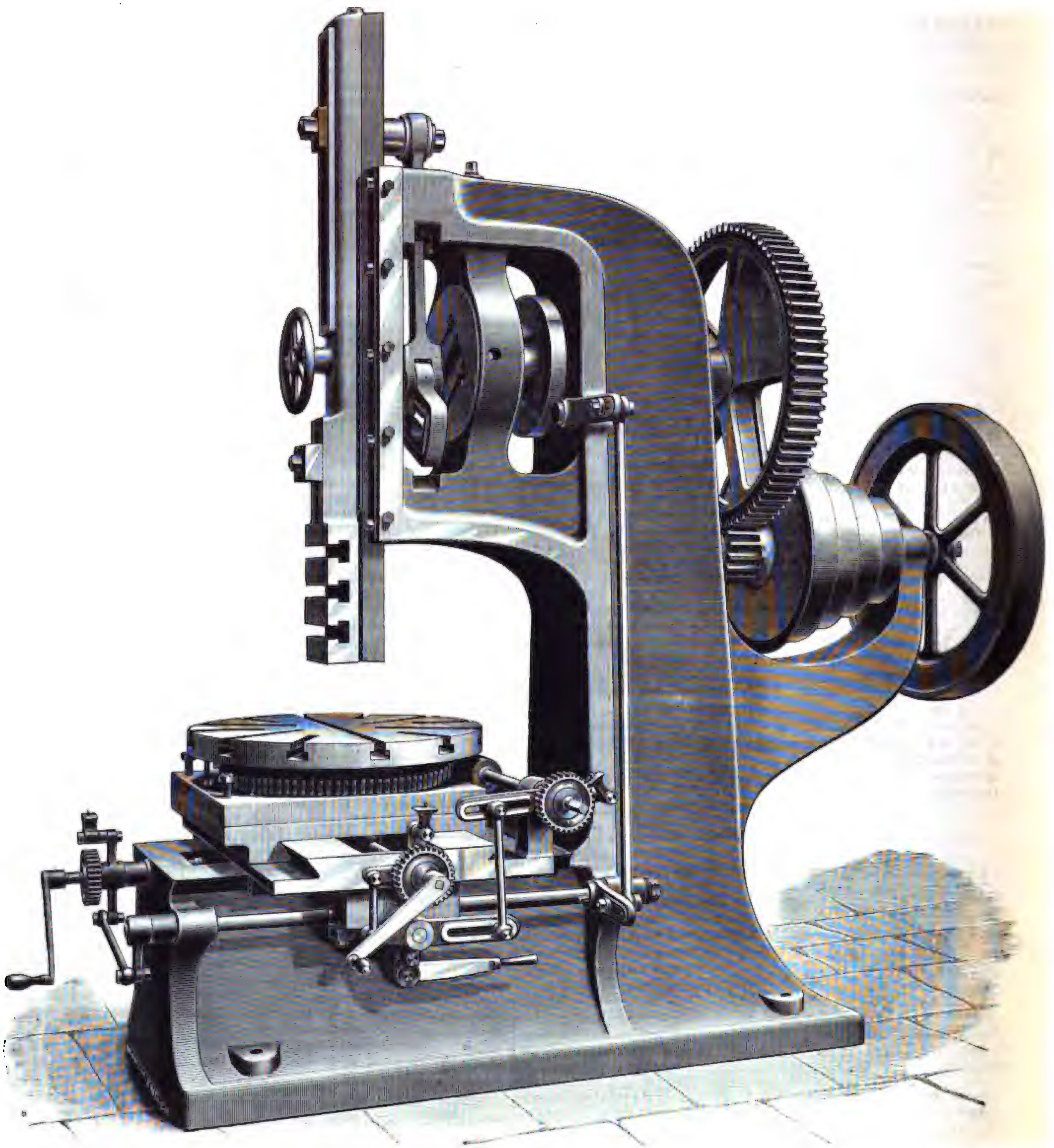
(*From our own Correspondent.*)

Launch of the "Speedy."

SO far as the Royal Navy is concerned, I have to chronicle but one launch, that of the *Speedy*, a torpedo gunboat from Messrs. Thorneycroft's yard at Chiswick, on May 18th. This vessel belongs to the well-known class of torpedo-boat destroyers, of which the prototype was the French *Bombe*. In our service we commenced with the *Rattlesnake*, of 550 tons, went on to the *Sharpshooter*, of 770 tons, and then to the class of which the *Speedy* is one, of 810 tons; a heavier class still is now in hand, of which the type ship is the *Halcyon*, of 1,070 tons, building at Devonport. The *Speedy* differs from her sisters of the same tonnage in that she is fitted with the Thorneycroft tubulous boilers, which have been such a conspicuous success in the Danish war vessel *Geiser*, and by their aid it is hoped that she will work up to 1,000 more H.P. than the boats fitted with ordinary boilers. The *Alarm* and *Niger* mentioned presently are in this category; their maximum contract power is 3,500, that of the *Speedy* is 4,500, and her builders hope to squeeze even more out of her. But the value of this species of boiler lies even more in the ease and celerity with which steam can be raised, than in the extra amount of power given in this particular case. The launch took place at Chiswick, when in the presence of a distinguished company, Lady Geo. Hamilton performed the christening ceremony, and the boat took the water without a hitch. The event is noteworthy for another reason, the *Speedy* being the heaviest war vessel ever built above-bridge on the Thames.

The "Powerful" and the "Terrible."

It was mentioned in my last Notes that no particulars of the design of these cruisers had at that time been made public, but that they promised to surpass anything of the kind built or building. It is now anticipated that by the beginning of July it may be possible to send out specifications to those private builders who may desire to tender for their construction. It is not probable that this category will be very extensive, for there are but few firms who can be qualified in every way that is desirable to undertake the construction of such huge war-



Improved Slotting Machine. (*See page* 107.)

ships. The displacement of these monster cruisers will not fall far short of 11,000 tons; the engines are to be made capable of developing 30,000 H.P. and to give a trial speed of 25 knots an hour. In length they will exceed even some Atlantic liners with 500 ft., while their beam will not be less than 70 ft., or as wide as that of many battleships. The protection will be a combination of that form which is used in the armoured deck type of craft with vertically-placed steel shields and casemates. It is to be noted that Admiral P. H. Colomb, in the *Times*, has attacked the policy which prescribes such monstrous vessels, and Lord Salisbury has uttered a note of caution in the House of Lords, but Lord Hood, of Avalon, the chief naval adviser to the late Government, and Sir Anthony Hoskins, chief naval adviser to the present one, with the majority of naval men at their back, are firmly of opinion that such vessels are needed, chiefly, it would seem, as a counterpoise to warships which possible enemies are constructing abroad.

Battleship Steam Trials.

The first-class battleship, *Ramillies*, built and engined by Messrs. J. & G. Thomson, of Clydebank, has concluded her contractors' trials. The vessel was not tried for speed and therefore was not brought down to load draught; acting also on the advice of the Boiler Committee, the covenant with the constructor's for H.P. had been reduced from a mean of 13,000 as originally proposed to 11,000 power, which was easily exceeded. The natural draught trial took place on May 8, when the engines developed a collective I.H.P. of 9,415 and a log speed of 16·75 knots. With a forced pressure of ·35 in. and a consumption of 2·17 lbs. of coal per I.H.P. per hour, a collective power of 11,549 horses was obtained, this trial taking place on Thursday, May 11. It is to be noted that during the first half-hour the power ran up to 12,000 horses, but by the desire of the naval officials the engines were eased down. A notable feature of the trial was the uniformity characterising the action of the double set of engines. The *Empress of India*, built at Pembroke, but supplied with boilers and machinery by Messrs. Humphrys, Tennant & Co., has also passed through her trial without a hitch. Her trial with natural draught took place Thursday, May 4, and her forced draught trial Saturday, May 6. At the former essay the power achieved was 9,507 horses on a seven hours' run, which is 507 above the stipulated amount; at the latter the engines with an air pressure of 1 in. worked up to 11,625 I.H.P., which is also in excess of the contract terms, while the patent log registered a speed of 18 knots.

Some Other Trials of Machinery.

The first-class cruiser *Endymion*, built and engined by Messrs. Earle, of Hull, was tried in the Channel on Friday, May 5, and found satisfactory. As the *Edgar* and *Royal Arthur*, sister ships, had already been tried for speed, the cruiser was not brought down to load draught; the run was for eight hours, and with an air pressure of ·17 in. the mean collective power indicated was 10,646 horses. The speed by patent log was 20·96 knots. The *Alarm*, torpedo gunboat, built at Sheerness, and supplied with engines and boilers by Messrs. J. Penn & Sons, passed through her trials with success on Monday, May 8, and Wednesday, May 10. The contract was for natural draught 2,500 H.P. and 17·75 knots, and for forced draught 3,500 H.P. and 18·5 knots. The result in the former case was 2,592 I.H.P. and 18 knots; in the latter, 3,884 H.P. and 19·2 knots, in both instances, therefore, the stipulated limit was exceeded. We are not aware what amount of pressure there was on the furnaces, but the H.P. is the highest yet recorded in this class. The *Niger*, built and engined by the Naval Construction and Armaments Co., of Barrow, has not been quite so successful. Tried for eight hours with natural draught on May 9, she developed 2,701·8 H.P., and a speed of 17·5 knots was registered. A forced draught trial took place on the following day, but some of the tubes in the forward boilers became so leaky after the fourth half-hour's run that the trial had to be abandoned. On May 15, the gunboat *Gossamer* commenced another 96 hours' continuous steaming in the basin in order to further test Martin's apparatus for induced draught. Before the expiration of the time, however, the boiler tubes gave way, and the trial was a failure. Further trials will be made after repairs.

Trial Trip of the "Superb."

On May 2nd this vessel, which is stationed in the coastguard Reserve at Greenock, went outside Plymouth Breakwater for her first four hours' forced-draught trial since re-engining. About three years ago the *Superb* was fitted by Messrs. Humphrys, Tennant & Co. with high-pressure double-ended boilers and modern machinery, which were intended to develop 8,500 H.P. with forced draught. As, however, her natural draught trial, with 6,000 H.P., caused considerable vibration, it was deemed inadvisable to subject the vessel to further pressure until alterations had been made. Apart from the vibrations, however, the trial was so satisfactory that the naval authorities felt justified in taking over the machinery and releasing the contractors. It was decided to decrease the pitch of her propeller by bending the tips of the blades aft, and to test how far this might obviate the defect. The ship being at Devonport for refit, this work of bending the blades was carried out, and then the trial took place. The result with an air pressure of 1·7-in. was an I.H.P. of 8,700 and a maximum speed of 15 knots per hour. As the estimated power was only 8,500 horses, and the vibration was hardly perceptible, this must be considered very satisfactory.

Chatham Dockyard.

Owing to Rear-Admiral Ernest Rice passing on to the flag-list the command of the Fleet Reserve has become vacant here, and it is understood will be filled by the appointment of Captain H. L. Pearson. Captain Andoe will also relinquish the Steam Reserve in July, and it is stated that Captain Lord Charles Beresford will take his place. It is a long time since such a numerous fleet was ready for service in this yard as at the present time, and the Admiralty are evidently desirous that work of all kinds should be pushed on. The battleship *Barfleur* has been wood and copper sheathed, and is having her submerged torpedo tubes and underwater fittings looked to. She will be ready for her machinery trials shortly; her engines, which have been supplied by Messrs. J. Scott & Co., of Greenock, having to develop 13,000 I.H.P. with forced draught, and a speed of 18½ knots. The first-class cruiser *Grafton*, delivered from the contractors, is also in dock here preparing for special speed trials, the intention being to get the original H.P. out of her if possible. She is to be ready for commission by August 1st. Ships passed or passing out of the dockyard reserve are *Empress of India*, *Ajax*, and *Scylla*; the refit of the *Pylades* is complete, and four ships of the Fleet Reserve have been commissioned. Messrs. Maudsley are supplying triple-expansion machinery for the *Monarch*, the new engines to be of 8,500 H.P., to give a speed of 14·75 knots. It will not be long before the *Forte* is ready for launching.

Ships Commissioned or Paid-off.

The *Achilles* did not leave Portsmouth with the new crew of the *Trafalgar* until April 28th, as her boilers took so long to clean out. She is fitted with old-fashioned jet condenser, burns 90 tons of coal per day, and has obsolete engines and boilers. It would pay to re-engine and boiler her. She has towed out the *Lark*, sailing sloop, which has been commissioned at Gibraltar, and rechristened *Cruiser*. The *Hawke*, first-class cruiser, and *Arethusa*, second-class cruiser, were commissioned at Chatham on May 17th; these vessels will not leave England until after the manœuvres. The order to commission the *Brilliant* to relieve the *Melpomene* on the Pacific station has been countermanded, and the latter ship will re-commission. The *Brilliant* is one of the vessels whose tubes have not yet been ferruled. The *Wanderer*, sloop, having had her machinery removed, has been commissioned as a sailing tender to the boys' training establishment at Portland. The *Barham* commissioned May 2nd, at Portsmouth, and has left to relieve the *Landrail* in the Mediterranean. A relief crew for the *Magpie* left England in the *Wye* on May 10th, for Ascension, where that ship will re-commission. The *Australia*, from the West Indies, where she proceeded to take part in the New York review, and the *Undaunted*, from the Mediterranean, are both ordered home to pay off. The *Tourmaline* has gone back to her station.

The Channel and Coastguard Squadrons.

The ships of the Channel Squadron have returned home to give leave to their crews, and prepare for the manœuvres. As was the case last year, orders have been given that the ships are not to be taken in hand for repairs until October. It is somewhat surprising, however, that they are not to be docked, as a clean bottom tends to economy in coal, and wear and tear of men and machinery. It is reported that the *Bellona*, dispatch vessel to the squadron, is suffering from a new kind of boiler complaint—her fire-bars buckle and bend to such an extent that sufficient surface is not left on the bearing bars, so that at the slightest jar they drop in the ashpit. This vessel's tubes are

to be ferruled before she goes to sea again. The Channel Squadron is to assemble at Portland at the end of May, in readiness for a short cruise before the manœuvres. Some of the changes which I stated were about to be made in the composition of the Coastguard Squadron have already taken place, although it was not so originally intended. The *Shannon* at Bantry was relieved on May 10th by the *Aurora* instead of the *Grafton*. The *Bellisle* has been superseded at Kingstown by the *Melampus*, brought to Devonport from Portsmouth for the purpose. On May 6th the *Galatia* took the place of the *Iron Duke* at Queensferry. On May 9th the *Hotspur* at Harwich was succeeded by the *Mersey*. The *Thunderer* has also taken the place of *Northampton* as port-guard ship at Sheerness, and it is now notified that on her return home from the Pacific, when the *Royal Arthur* has relieved her, the *Warspite* will replace the *Triumph* as port-guard ship at Queenstown.

Pembroke Dockyard.

The vessels in hand at this yard are the *Renown*, *Cambrian*, *Flora*, and *Hazard*. The first named is now being put together pretty fast, but what is imperatively required here, if the yard is to have fair play in competition with others, is up-to-date plant. It may also be mentioned that the draught of water over the sill of the only dock is no more than 22 ft., while there is no basin at all. The wood sheathing of the *Flora* is nearly completed. The boilers and machinery of the *Hazard* will be fitted on board and decked over before the vessel is launched, a method for which it is claimed that it will tend to cheapen construction and facilitate completion. No date is yet fixed for the launch. The tubes of the boilers in the *Cambrian* are to be ferruled prior to her running trials.

Re-commissions Abroad.

The following ships on foreign stations will be re-commissioned during the ensuing twelve months:—In the Mediterranean, the *Polyphemus*, *Dolphin*, and *Imogene*, which were all last re-commissioned at Malta, on 7th October, 1890. In the Pacific, the *Melpomene*, which was commissioned at Portsmouth on 17th June, 1890; her crew will be relieved at Esquimalt. On the North American and West Indian Station, the crews of the *Magicienne*, *Basilisk* and *Mohawk* will be relieved at Bermuda; the *Magicienne*, commissioned at Portsmouth on the 15th April, 1890; the *Basilisk* at Sheerness, on the 24th June, 1890, and the *Mohawk* at the same port, on 16th December, 1890. On the China Station, the *Egeria*, *Firebrand*, *Swift*, *Rattler*, *Porpoise* and *Imperieuse* will all re-commission at Hongkong; the *Egeria*, recommissioned at Sydney on 10th December, 1889, and the other five at Hongkong, the *Swift* and *Rattler* on 24th February, 1891, and the *Imperieuse*, *Porpoise* and *Firebrand* on 29th March, 1891. On the Cape of Good Hope and Coast of Africa Station, the *Sparrow*, *Widgeon* and *Blanche* are to be re-commissioned at Simon's Bay; the *Sparrow* and *Widgeon* were commissioned on 13th May, 1890, at Sheerness and Devonport, and the *Blanche* was commissioned at Devonport on 30th December, 1890. On the East Indian Station, the *Redbreast*, *Marathon* and *Lapwing* will re-commission at Trincomalee; the *Redbreast* was commissioned at Devonport on 27th February, 1890, and the other two ships at Portsmouth and Devonport on 16th September, 1890. On the Australian Station, the *Ringdove*, which was commissioned at Devonport on 16th September, 1890, will be re-commissioned at Sydney.

Portsmouth Dockyard.

The *Centurion*, sister to *Barfleur*, is well advanced at this yard, but will not be ready for trials so soon as the latter vessel. The *Crescent* has made satisfactory contract trials, and the *Fox*, which will take the water in June, has been ready for launching some time, but is now being wood-sheathed on the stocks. The ships of the Coast-guard Reserve which have been here, have finished their refit. The *Gibraltar*, first-class cruiser, recently delivered from Napiers', was to have made her trials on May 11th, but had them postponed in consequence of a defect having to be made good. This vessel is sheathed and coppered, which adds a matter of 350 tons to her displacement, and subtracts a quarter of a knot from her speed. Her engines will only be asked to develop 10,000 H.P., just as those of the *Endymion* were. It is deemed probable, that when the *Achilles* returns here with the paid-off crew of the *Trafalgar*, she will be further employed to take new crews to the *Colossus* and *Inflexible*, but it is more likely that the *Colossus* will come home to replace a vessel in the Coast-guard Squadron. During the first week in May a trial was made here with the *Seagull*, which has had copper sleeves rolled into the tube-plate ends of her steel boiler-tubes in half her boilers. With an air-pressure of 4 in. a collective power of 1,731 horses was realised, her engines making 205·9 revolutions a minute. This is an alternative plan for preventing leakage, and the test is considered satisfactory. The *Hecla* has returned to this yard from the Mediterranean for refit, but it is improbable that the *Vulcan*, completing here, will relieve her before the manœuvres take place. If it is necessary, however, or the *Vulcan* is to make a trial trip this summer, she could be ready in less than a fortnight. The *Hercules* and *Iphigenia* are ready to turn over to the Fleet Reserve. The *Nelson*, guardship at this port, will be replaced here, about the end of August, by the *Devastation*, and will then be sent to Malta to take the place of the *Hibernia*.

Mishaps to Ships and Boats.

While No. 55 torpedo boat, of Thorneycroft 125 ft. type, was running in Plymouth Sound, for the instruction of stokers, a securing-stud suddenly snapped, the plug of the feed-cock blew out, the stokehole became full of steam, and the men who were below got badly scalded. As soon as he discovered what had happened, the engine-room artificer in charge of the boat put on the extinguisher and run the boat at full speed, thereby reducing the pressure of steam in the stokehole. A report of the accident was sent to the Admiralty, and an inquiry is to be held to ascertain if alterations are necessary to prevent a possible recurrence of such a mishap. From Hongkong comes a report, which has been confirmed at the Admiralty, that during the voyage of the *Daphne* from Esquimalt to the China Seas, one of the furnace crows came down and the boiler burst. No one was seriously injured by the disaster, and the result of the court-martial is not yet known. The vessel continued her journey with one boiler. During some torpedo boat manœuvres at Malta one of the boats, No 21, came to grief by running into the *Nile*, and two others by collision together. The *Audacious*, coast-guard ship at Hull, while proceeding down the Medway, after refit, ran on a mud-bank, but came off again without injury.

Sheerness Dockyard.

To expedite the construction of the *Hebe* and *Charybdis* overtime has been worked here, but it will not continue so for long as the *Torch* and *Alert* of the new programme will not employ so many hands. The *Charybdis* was to have been launched May 17th, but she was not sufficiently advanced, and is now being planked on the stocks. Her engines are to come from Messrs. Earles', of Hull, and she will now take the water on the 15th of June. The *Niger*, a sister gunboat to the *Jason* and *Jaseur*, has been delivered here from Barrow, and the vessels mentioned as ready in last month's Notes have been passed into the Medway Steam Reserve. Preparations are being made to commence the construction of the *Alert* and *Torch* gun-vessels.

The Engine-Room Complements.

The Admiralty policy in the matter of engineer *personnel* is beginning, says the *Globe*, to bear fruit. In the middle of the *Galatea's* trial, her chief engineer, Mr. Underhill, fell down exhausted, overcome partly by the heat, and partly, of course, through the exhaustion caused by the previous excitement and worry of commissioning a ship of that class, himself and the whole of his staff being completely ignorant of her peculiarities. The Chief Inspector of Machinery did what he could to give him men who had previously served in the ship, but the condition of affairs had gone beyond the possibility of repair. It was, perhaps, necessary that the chief engineer, Mr. Tricker, should be sent to China, and the authorities could not help the invaliding of his successor, Mr. Craddock; but all this shows the absolute need of having a second string in the shape of an efficient senior engineer on board ships like the *Galatea*, of 8,500 H.P. Meanwhile Underhill is in hospital, suffering from nervous exhaustion and consequent cerebral excitement. Fleet-engineer J. L. Stevenson has just been invalided from the *Abyssinia*, and engineer Pill from the *Plassy*, and the *Daphne* is disabled for at least three months by trying to work without water in the boilers.

The Home-coming of the "Howe."

The temporary repairs to the *Howe* at Ferrol are being rapidly pushed on, and it is anticipated that she will be ready to leave for Portsmouth about June 18. The injuries which the vessel has sustained are sufficiently serious, the inner bottom having been damaged on both sides, while the keel is terribly broken and twisted. The largest hole on the port side is 27 ft. long by 12 ft. wide. The vessel will come to Chatham for repairs, and the assistant constructor, who was sent out to

report upon her state, is said to give six months at the outside to make the ship as good as new. It is not generally known, but although the Salvage Co. was of foreign origin, Messrs. Hayward, Tyler & Co.'s universal steam pumps have played a very important part in the salvage of the vessel, five of the ten pumps used being of their make. Of these five pumps, two were throwing 150 tons per hour, and three 300 tons per hour, or a total of 26,000 tons per day. It speaks well for these pumps, which appear to be specially adapted for salvage purposes.

DEVONPORT DOCKYARD.

There is plenty of work going on at this yard and its neighbour at Keyham. The *Astræa*, *Bonaventure* and *Antelope* are being pushed on with all possible celerity. The *Bonaventure*, engined by Messrs. Hawthorne & Leslie, is to have her tubes ferruled previous to making her trials, for which she should be ready in August. It is likely that the tubes of the *Astræa*, *Pique* and *Bellona* will receive the same treatment. The *Astræa* has already received her machinery and boilers, and the decks are being closed over them. Her engines were built in Keyham, and her steam trials will come off either in August or September. The *Calypso*, of the Training Squadron, the *Aurora* and the *Tamar* have been in hand here for various defects to be made good. In the first-named of these vessels it was discovered that a number of the bolts holding on the wooden sheathing were useless from corrosion; it will, therefore, most likely be found necessary to resheath her, unless some temporary expedient is adopted. The Teignmouth Ship and Yacht Co. are building for the Government Service twelve gigs, varying in length from 18 to 25 ft., which, when finished, are to be delivered at this yard for the equipment of vessels here. The *Antelope* gunboat will be launched on the 29th of June, and the *Hermione* cruiser in November. The *Sybille*, *Pique* and *Retribution* are preparing for steam trials. The *Rupert*, which has been re-engined at Portsmouth, is to be brought to this yard, to relieve the *Bellerophon* as Portguard ship at Pembroke.

Miscellaneous.

The Gold Medal and Diploma of the "Académie Parisienne des Inventeurs," Paris, has been awarded to Mr. Geo. Langley, M.E., of Brixton, for an "Improved Martin Anchor," which can be seen at the Chicago Exhibition.

Change of Address.—Crosier, Mills & Co. are removing their offices from 9, Queen Street, to 58, Collingwood Street, near the Central Railway Station, Newcastle-on-Tyne. There they will also have a show-room for the display of machine tools, Mills' boat gear, Cromil bronzes, and other engineering specialities.

The Steamer "Zanzibar."—Cold-flanging in Shipbuilding.—This large vessel was very seriously damaged a short time ago by running on Pearl Rock, near Gibraltar, and after considerable trouble and risk was successfully salved and brought to Hartlepool for repairs, which are being done by Messrs. Furness, Withy & Co., in the large Central Graving Dock at this port. The floors, keelsons, keel, &c., in the bottom of the vessel are torn and distorted in every conceivable manner, yet the tank tops have remained intact, thus enabling the vessel to float on her inner bottom, and allowing the vessel and cargo to be salved, which probably would not have been the case if the tanks had not been built on the cellular double-bottom principle. From a careful examination of the structure of the ship we notice that a very large amount of cold-flanging in connection with the material has been adopted, also the use of sectional framing. It will be remembered that we called the attention of our readers a short time ago to the new system of shipbuilding that Messrs. Furness, Withy & Co. had introduced, and which has been patented by their manager, Mr. G. W. Sivewright. We commented at that time on the superiority of flanging and sectional work over the ordinary combination of riveted bar with plates, and in this vessel the most striking illustration is witnessed, proving the superiority of this design of structure; for wherever there is a riveted bar the whole of the rivets appeared to have sheared, but where there is a flanged plate, although the plate may have been distorted in a most extraordinary manner, yet in no case has the flange given way. The sectional framing in connection with the ribs of the vessel have stood the damage very well indeed, although in the vicinity of this sectional material the riveted bars and plates have entirely collapsed. Notwithstanding so much damage has been done in the bottom of the vessel, the whole of the topsides appear to be in perfect condition, there being no evidence of straining or sagging, which certainly speaks well for the design and workmanship of this type of vessel. It may be added that 170 ft. of the bottom has been ripped up.

Contract for Dundee Shipbuilders.—Messrs. W. B. Thompson & Co., Limited, shipbuilders, Dundee, have contracted to build a steel screw steamer to the order of Messrs. James Rankine & Son, Glasgow. The vessel will be about 1,000 tons gross register, her dimensions being as follows:—Length, 240 ft.; beam, 32 ft.; depth, 15 ft. The steamer is to form one of the Messrs. Rankines' regular trading steamers between Grangemouth and Rotterdam, and will be fitted to carry passengers and cargo between these ports.

The "Campania."—The latest addition to the Cunard Line fleet of steamers, the *Campania*, has accomplished the passage from New York to Queenstown in 5 days 17 hours 27 minutes, thus eclipsing all previous eastern passages.

Ferrules in the Navy.—A trial has been made, at the suggestion of the Engineer-in-Chief of the Navy, on board the gunboat *Seagull*, at Portsmouth, of a new device for preventing leakage in boiler tubes. Ferruling has enabled the engines of ships in the Navy to develop their maximum power, but the ferrules require renewing, and they have the further disadvantage of rendering the process of sweeping tubes a matter of difficulty. The new invention consists in fitting the tubes at the furnace end with copper sleeves of the same diameter as the tubes themselves. One-half of the *Seagull's* boilers have been so fitted, and they were steamed for three hours, the other boilers not being lighted. The newly-treated boilers were tested to the extreme degree of 4·1 in. of air-pressure. This gave a mean steam pressure of 113 lbs.; and with the high vacuum of 29 in. and 205½ revolutions the starboard engine developed 872, and the port engine 859 horses, resulting in a collective I.H.P of 1,731. With all the fires alight at the official trial the power realized was 3,200. The speed of vessel was not taken. The trial was considered satisfactory.

A Fast American War Vessel.—The new American cruiser *New York*, built by Messrs. Cramps, of Philadelphia, has made her official trial trip off the New England coast east of Cape Ann. The sea was smooth and the weather fine. The course of 83·3 knots was covered in 3 hours 57 minutes at an average speed of 21·07 knots under forced draught. This may be slightly changed after allowance has been made for tidal influences. The average revolutions were 135, and the I.H.P. 17,000. Messrs. Cramps will get a premium of about 200,000 dols. above the contract price for the speed and H.P. obtained. The *New York* returned to Delaware Breakwater. This result, which proves her to be one of the swiftest warships afloat, gives great satisfaction throughout the country. A Reuter's telegram, dated New York, May 23rd, states: "The speed trial of the new armour-clad cruiser *New York*, 8,150 tons, has proved most satisfactory. Over a measured course of 82·65 knots she steamed at an average speed of 21·07 knots an hour, thus winning for her builders a premium of 200,000 dols., the largest ever paid in any country. The vessel has cost about 3,000,000 dols. She is 380 ft. in length, with 64 ft. beam. She has a collective H.P. of 18,000, derived from four separate engines of 4,500 H.P. each.

Institution of Engineers and Shipbuilders in Scotland.—An adjourned meeting of this institution was held in the rooms, 207, Bath Street, Glasgow, on Tuesday 2nd, when the business unfinished at the annual general meeting held on 20th April was taken up, and the work of the session terminated. The business was principally the discussion of the following papers:—On "Some Causes of Failure in Tunnel Shafting," by Mr. W. Carlile Wallace; on "The Speed Constants of Ships," by Dr. Francis Elgar, F.R.S.E.; on "Testing Machinery and Electric Recording Apparatus," by Mr. John Barr; on "A Sloping Concrete Block Breakwater at Emu Bay, Tasmania," by Mr. W. Reid Bell. Interesting discussions took place upon these papers, and votes of thanks were passed to the authors. The plebiscite, arranged to be taken of the views of the members as to the relative suitability of Tuesday or Wednesday evenings for the general meetings, resulted in a majority in favour of Tuesday, the day at present, and for a long period devoted to the monthly meetings. The Secretary again referred to the forthcoming Engineering Congress at Chicago (July 31 to August 5), and stated that from letters he had received from various societies in America any of the members of this institution attending the meetings might be assured of a cordial reception.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from April 25th, 1893, to May 26th, 1893:—

Bath, George C., engineer to the *Vivid*, additional, for the *Antelope*, in lieu of a chief engineer, to date April 25th.
Bills, Walter W. (probationary), assistant engineer to the *Hood*, to date June 1st.
Blundell, Stephen Henry, chief engineer, has been advanced to the rank of staff engineer in H.M. fleet.
Craddock, George Thomas, fleet engineer, has been placed on the retired list of his rank.
Cudlip, Edwin W., engineer to the *Aurora*, to date May 3rd.
Douglas, Charles E., assistant engineer to the *Royal Sovereign*, to date May 9th.
Follett, Samuel G., staff engineer to the *Aurora*, to date May 3rd.
Froud, William T., engineer to the *Vivid*, to date May 10th.
Goodall, George T., engineer to the *Galatea*, to date May 3rd.
Harvey, William A., fleet engineer to the *Belle Isle*, to date April 27th.
Henwood, John William, chief engineer, has been advanced to the rank of staff engineer in H.M. fleet.
Huddy, Charles J., engineer to the *Cordelia*, to date May 12th.
Jarvis, Frederick, engineer to the *Emerald*, to date May 12th.
Kerr, John, chief engineer to the *Shannon*, to date May 3rd.
King, Quentin W., engineer to the *Scout*, to date May 10th.
Langmaid, Joseph, staff engineer to the *Vivid* for the *Gorgon*, to date May 10th.
Little, Herbert J., assistant engineer to the *Calypso*, to date May 12th.
Main, Reuben, assistant engineer to the *Volage*, to date May 3rd.
Mandling, William J., staff engineer to the *Victory*, additional, for the *Royal Oak*, to date April 25th.
M'Gregor, William, engineer to the *Benbow*, to date May 1st.
Monk, Joseph, fleet engineer to the *Iris*, to date May 12th.
Monkhouse, Warwick, engineer to the *Melampus*, to date April 27th.
Moon, Henry J. J. G., staff engineer to the *Hotspur*, to date May 9th.
Moysey, Alfred H., engineer to the *Active*, to date May 9th.
Moysey, John, fleet engineer to the *Abyssinia*, to date May 12th.
Nicolson, Gilbert C., assistant engineer to the *Hood*, to date June 1st.
Page, Frederick J., engineer to the *Hood*, to date June 1st.
Peacock, David, engineer to the *Hawke*, to date May 16th.
Pounds, Thomas H., engineer to the *Arethusa*, to date May 16th.
Priston, Robert B., staff engineer to the *Hawke*, to date May 16th.
Rayner, Alfred, chief engineer to the *Mercury*, to date May 9th.
Robins, Samuel J., staff engineer to the *Pembroke*, additional, as Admiralty engineer overseer for Liverpool and Barrow district, to date April 25th.
Roome, George W., engineer to the *Hood*, to date June 1st.
Rule, Thomas, staff engineer to the *Vivid*, additional, for the *Astrea*, to date April 25th.
Saunders, Alfred (probationary), assistant engineer to the *Arethusa*, to date May 16th.
Serle, Richard T., staff engineer to the *Bellerophon*, to date May 10th.
Simmons, George T., chief engineer to the *Arethusa*, to date May 16th.
Smith, Alexander G., fleet engineer to the *Galatea*, to date May 13th.
Stevens, John G., chief engineer to the *Plassy*, to date May 12th.
Stewart, Cornelius H., chief engineer to the *Melampus*, to date April 27th.
Swinney, Edward, engineer to the *Hood*, to date June 1st.
...st J., engineer to the *Research*, to date April 27th.
Thompson, James M., engineer to the *Seagull*, to date May 12th.
Underhill, Charles, chief engineer to the *Galatea*, to date May 3rd.
Wallis, William A., assistant engineer to the *Hawke*, to date May 16th.
Weeks, Edward J., assistant engineer to the *Hawke*, to date May 16th.
Wheatley, George E., engineer to the *Mersey*, to date May 9th.
White, George, staff engineer to the *Hood*, to date June 1st.
Wright, John R. B., staff engineer to the *Defiance*, additional, for torpedo store at Devonport.

HOAR & BROWN'S HARDWOOD MARKET REPORT, 24th MAY, 1893.

TEAK.—The poor spirit displayed lately among consumers, while stocks are being offered at such low values, only goes to confirm the fact that with teak low prices do not help to force consumption. With trade at its worst, money is being held in reserve against difficulties likely to present themselves at any moment, and it is scarcely to be expected that many outside holders will come in even at half-price. This was demonstrated at the sale without reserve last week but one, when over 500 loads were offered and sold at ruinous figures. A large quantity of this timber finds its way to the North, where no doubt buyers are more alive to bargains. Excepting for this sale things have been more or less quiet during the month, only hand-to-mouth purchasers being about. A good feature noticeable is the preparation for delivery of a considerable quantity for H.M. Government, which will lighten the appearance of the teak field, and should arrivals at this port continue scarce, as in every probability they will, holders may look forward to more satisfactory trade.

Planks also have lately been sold at absurdly low prices, some of which are below the record.

MAHOGANY.—The price of 16 to 20 in. wood has again dropped now reaching an exceedingly low point, while good sizeable logs are realizing the old figures, and the minimum remains the same, Spanish is arriving freely, but of good quality and sizes, which is not likely to damage the market. Cuba holds its own in consequence of importations being reduced to a fair limit, although small sizes are difficult to dispose of, and are being held by the brokers.

It is generally expected that mahogany of all kinds will be lower in value during the next few months, after which period an advance is anticipated.

CEDAR.—There is barely anything doing for want of stocks. Prices naturally are firm.

AMERICAN WALNUT.—Good parcels scarce, but arrivals of inferior logs are large and have a very depressing effect upon the market, the low quotations which are about doing much damage to stockholders.

Boards and planks are in good demand.

WHITEWOOD.—Logs are still going badly, but boards and planks continue to harden in value. While high prices continue, consumers will turn their attention to other cheaper descriptions of wood as substitutes.

SEQUOIA.—A small trade doing at reduced figures.

KAWRIE PINE.—Some good sales have been made, and inquiries are frequent. The market is firm.

GREENHEART.—Stocks are quite large enough for present requirements, as the demand is decidedly limited.

PADOUK.—There is a very small stock, and further importations are necessary, and would meet with a ready sale.

Business has been much restricted lately, and purchasers are cautious not to over-stock themselves during these troubled times.

Institute Marine Engineers.—The third annual dinner of the Institute of Marine Engineers takes place at the Holborn Restaurant, on Wednesday evening, June 7th, at 6 for 6.30 p.m. The President, Mr. W. H. White, C.B., F.R.S., LL.D., will occupy the chair. It is expected that a large number will attend, and promises to be a great success.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(From our own Correspondent.)

DESPITE the depressed state of the shipbuilding and engineering trades, and the lack of remunerative freights, one or two new contracts have been booked during the month, though as far as can be ascertained the prices obtained are barely sufficient to cover the nett cost, and it is only in preference to shutting up yards that some of the contracting firms have come to terms. Many builders are very badly off for work and there is no inducement just now to commence building on stock. Greenock and Port-Glasgow are receiving more than their share of the work that has come to the Clyde during the past month, but considering the deserted look that the yards there had a month ago, no one can reasonably grudge them this respite. Messrs. Scott & Co., Greenock, who, as noted in our last issue, had got an order for a small steamer, have secured a contract to build a steel screw cargo steamer of 1,250 tons for Messrs. J. & J. Denholm, of the same port, and they have also been commissioned to construct a steel steam yacht of 235 tons for Lord Carnegie. Messrs. Kincaid & Co., also of Greenock, are to supply triple-expansion engines of 600 H.P. for a 700 ton screw steamer, building at Messrs. Murdoch & Murray's Port-Glasgow yard. Messrs. Russell & Co., Port-Glasgow, have received an order to build a sailing vessel for Captain Fairley, of Glasgow, whilst at their Greenock yard they have contracted to build a sailing ship of 1,600 tons register for Messrs. Crawford & Rowat, of Glasgow. Messrs. Gibson & Clark, of Glasgow, have commissioned Messrs. Robert Duncan & Co., Port-Glasgow, to build a ship of 2,850 tons deadweight as an addition to their "Pass" line. As is very common when trade is in its present state, numerous rumours are being circulated, and it is only by direct enquiries that the real state of the order market can be obtained. About the middle of the month it was stated, and very largely believed, that Messrs. J. & G. Thomson, of Clydebank, had contracted to supply two Red Star liners and a battleship for the British Government, but this is now absolutely contradicted, in fact the only order placed on the north side of the Clyde has been one for a sailing ship for Messrs. John Black & Co., Glasgow, and Messrs. Macmillan & Son, Dumbarton, have been the fortunate recipients. The only order of note placed on the East Coast of Scotland has been that for a steamer, of about 1,000 tons gross register, placed with Messrs. W. B. Thomson & Co., Dundee, by Messrs. Rankine, of Glasgow. The builders will supply the vessel with engines to indicate 1,500 H.P.

The booking of the few new orders during the past three months have helped to dispel the very bare appearance which a number of the yards on the Clyde had, and most notably in the yards of Messrs. Henderson, Meadowside; Messrs. Barclay, Curle & Co., Whiteinch; and Messrs. Stephen & Sons, Linthouse, quite a brisk appearance is visible from the river, the aggregate tonnage on hand in these three yards being between 25,000 and 26,000 tons. The Fairfield Co. are making rapid progress towards the completion of the large Cunarder *Lucania*, and it will not be long before the trials of this vessel are announced. In their yard only two vessels are under construction, and very rapid progress is being made with one of them, the fast paddle steamer for which they secured the order quite recently. A considerable quantity of tonnage was placed in the water during the past month, and a very fair output will also be recorded in the month of June.

The steamer *London City*, which was launched from Messrs. Alexander Stephen & Son's yard for the Furness Line, and which was described as the largest cargo steamer ever built on the Clyde, has been purchased by a London firm. The East Coast Salvage Co., Limited, of Leith, have entered into a contract with the Mayor and Corporation of King's Lynn, Norfolk, to float the wreck of the s.s. *Wick Bay*, which, four years ago, sank in the Navigable Channel seven miles below Lynn, and broke in two. Several ineffectual efforts have been made to accomplish the work before, but the Salvage Co. will succeed if it is within the range of possibility. It is understood the undertaking will occupy three or four months.

The Carron Steamship Co. have issued a guide book of their route from Grangemouth to London, and considerable interest has been attached to the fac-simile of an advertisement of the firm in *The Edinburgh Advertiser* of March, 1779, announcing that their vessel, "the *Glasgow*, Robert Paterson, master, mounting fourteen twelve-pounders, and men answerable" would sail on the 5th of that month. One of the most interesting functions performed on the Clyde during the past month was the official test of the large 150 ton crane, recently completed at Finnieston Quay to the order of the Clyde Trustees, and a description of which we publish elsewhere. Another matter of interest was the accepting by the Leith Dock Commission of Messrs. Kinnear, Moodie & Cos'. tender for the construction of a reclamation embankment on the foreshore, and a wet dock, graving dock, and relative works on the east side of the Harbour of Leith.

At most of the Lanarkshire collieries, on the 22nd, work was suspended as a protest by the miners against the reduction of 6d. a day, which has been intimated by the employers. There being an over-abundant supply at all points, no inconvenience was caused, and it is understood work will be resumed immediately.

The coal shipments are showing a slight improvement now, and it is hoped that prices will not go any lower than they are at present. The aggregate shipments from the principal Scotch ports for the present year amount to 506,308 tons, as compared with 577,455 tons for the same period last year, a decrease of 71,147 tons. Very little is doing in the pig-iron warrant market, but prices are firm and slowly rising.

The Clyde river steamers are now very generally placed on their various stations, and it is evident that the owners expect a good season from the care which has been taken in every case in the redecoration and altered speeds of a considerable number of them.

In regard to Messrs. Cumming & Ellis's shipyard at Inverkeithing, where a powerful steam trawler was launched on Thursday, the 18th inst., a description of which will be found in our launch columns, we note that this firm have now got this yard, which they took over about two years ago, in full working order. Complete new plant of the most modern description has been laid down. Messrs. Cumming & Ellis have got around them a specially good class of workmen, and the burgh of Inverkeithing has materially benefited by the addition to its population. Besides the trawler just launched, they have on hand two steel sailing barquentines to carry 600 tons deadweight, and they have every prospect of booking several others shortly. As indicative of the dispatch with which they are now enabled to execute work entrusted to them, the whole of these three vessels, which were contracted for practically at the one time, were all guaranteed for delivery within four months, the several times being, for the trawler, three months; one sailing ship three and a half, and the other, four months. Messrs. Cumming & Ellis's experience, both practical and theoretical, is of the widest description, and there is every prospect that the shipyard at Inverkeithing will go on and prosper under their management.

TRADE NOTES FROM THE TYNE, WEAR, TEES, HARTLEPOOLS, &c.

(From our own Correspondent.)

THE TYNE.

Shipbuilding.—So far as can be gathered from reliable sources, no new orders for ships have been booked in this district during the past month, and certainly no additional keels have been put down. Besides the dulness in the shipping trade, which is no doubt the chief obstacle to the promotion of new business in building, the fact that the employers' relations with different sections of workmen have been somewhat unsettled may perhaps be looked upon as in some degree accountable for the dearth of new orders. We were enabled to announce last month the acceptance of a wages reduction by the principal section of the operatives, and it is to be regretted that a similar announcement could not have been made at the same time with regard to the other sections. If the whole business had been completed a month ago, as it might have been, the shipbuilders would have been free to give their attention to the important matter of contract seeking, instead of having to sit out protracted meetings almost every other day to settle a question of wages reduction with the representatives of one or other of the various sections of men employed in the yards. This question of a readjustment of wages rates has now been in abeyance for more than two months, with the result (as we have already indicated) that business enterprise has been more or less hampered by the uncertainties of the situation. Such delays are as hurtful to the men as the employers, and might easily be avoided if an arrangement was arrived at by which wages reductions should

apply to all sections simultaneously, and by which deputations from the workmen to discuss such matters with the employers should be representative of all the sections concerned. Unduly prolonged controversies between employers and employed as to wages arrangements or other matters are, it will be admitted, most undesirable, and it is with a desire to minimise such hindrances to prosperity that the foregoing suggestion is put forward. Under the method of arranging matters that has been pursued on the present occasion, all sections of operatives, excepting the joiners, have agreed to a reduction, and though the latter have up to the present shown a disposition to resist any change, it is probable that in the course of a few days a satisfactory settlement will have been effected with them also.

For some weeks past there has been a gradual lessening taking place in the number of hands employed at Messrs. Armstrong, Mitchell & Co.'s Elswick yard. This is owing to the circumstance that certain vessels which have engaged the services of the men for many months are nearing completion, while the new work that has been started is not yet in a sufficiently advanced state to admit of many hands being employed on it. The new work recently put down consists of a large cruiser, which is partly framed, and another vessel of the same type, for which the keel is laid. The latter vessel is to be nearly 500 ft. in length, and of proportionate dimensions in other respects, and will probably be the largest, as well as the fastest cruiser, yet turned out from any English yard. Owing to the great length of the vessel, the keel occupies the space usually allotted to two vessels, being placed diagonally across the building berths. At the Low Walker yard belonging to the same firm, great briskness still exists, nearly all the vessels in progress being intended for employment in the oil carrying trade. The two other yards at Low Walker, Messrs. Dobson's and Messrs. Richardson's, also continue to be well employed, the vessels on the stocks at the last-named establishment being chiefly passenger boats. Messrs. C. S. Swan & Hunter launched on the 15th inst., the largest cargo boat yet built on the Tyne. The vessel, which has accommodation for a limited number of passengers, has been built to the order of a Sunderland shipowner. The firm have three other vessels in progress, and have one to put down in the berth just vacated. The neighbouring yard of Messrs. Schlesinger, Davis & Co. is still without work, but it is thought probable that at least one of the empty berths will soon be occupied. Business at Messrs. Hawthorne, Leslie & Co.'s yard has much improved within the past few weeks, but at the adjoining establishment of Messrs. R. Stephenson & Co. no change for the better can be noted. The Palmer's Co.'s yard at Howdon, as also the yards of the Tyne Shipbuilding Co. and the Edward's Co. at the same place, are kept in steady operation, and briskness is still the feature at the establishment of Messrs. John Readhead & Sons. It is reported that the latter firm are about to lay down a large vessel ordered by local owners. It is to be hoped that the statement may be correct, but, up to the present, it requires confirmation. The yards that are devoted to the building of small craft, such as fishing vessels and tugboats, continue fairly busy, and most of the graving docks are occupied with vessels undergoing repair or painting. Since last month a number of the laid-up vessels in the Tyne have found employment, owing doubtless to the opening out of North Sea navigation.

Engineering.—The wages question being now settled with all classes of workmen in the engineering trade (a reduction having been acceded to in every case), the employers have nothing to prevent them from applying their minds to the task of obtaining new contracts to replace those that are being completed. That the task is no easy one may be inferred from the large amount of inoperative machinery in the district. So far as marine engineering is concerned, the same firms which were reported busy a month ago, are still enjoying the enviable distinction, as the extreme slackness which then characterised the other works, has become, if anything, more accentuated. Even in the busiest establishments, however, the available productive resources are not being fully utilised, while the output is considerably below what it might be made if pressure were necessary. In the locomotive establishments there is very little activity to be noticed, but some good contracts have been secured for the hydraulic departments of Messrs. Armstrong & Mitchell's and Messrs. John Abbot & Co.'s works. Messrs. Allen & Robson, machinery agents, &c., have removed from Dean Street, New- Collingwood Street, where they have engaged extensive [illegible]d show-rooms. The firm have added several new agencies to their list, including those for the sale of Stockport gas-engines and "Blackman" air propellers. They have also become the representatives in Newcastle and district of the Globe Engineering Co., Limited, of 38, Victoria Buildings, Manchester. Messrs. Crosier & Mills, whose place of business has been at No. 9, Queen Street, have also removed to premises in Collingwood Street, which, being a more central position, is better adapted to the development of their business. The various departments of Messrs. Emerson, Walker & Thompson Bros.' Works are kept in a fair state of activity, and at the Dunston Engine Works, where considerable extensions are being carried out in view of a probable extension of the business at no distant date, the present condition of work is satisfactory. New coal shipping staiths, which will be ready for use towards the end of the year, are being erected by the North Eastern Railway Co. at Dunston, and it is expected that the increased trade for steamers, which is likely to result, must cause a considerable addition to the available employment for engineering establishments in the vicinity. Messrs. Donkin & Co., of the St. Andrew's Engine Works, have during the month consigned several large steering gears to Germany, and they have now in hand a number of similar machines ordered by shipowners in the United Kingdom. The firm have also several orders for engine-room telegraph and other specialities, and are kept fairly busy considering the serious falling off that has taken place in the demand for steamship accessories. Messrs. Carrick & Wardale are kept busy in several departments of their works, and more especially in those that are not dependent for the maintenance of activity on the manufacture of pumps for steamships. The well-known speciality of the firm in the latter line is usually much sought after; but the depression in shipping and shipbuilding has caused a lull in the demand, which is to be hoped will not be of long duration. Messrs. Ernest Scott & Mountain, Limited, are well supplied with orders for their engineering specialities, a large proportion of the contracts now in progress having been received from an important local company. The Newburn Works of Messrs. John Spencer & Sons continue fairly well employed, and in the steel plate mills some extraordinarily large plates for shipbuilding purposes have been recently manufactured. The boiler and tank works of Messrs. Thos. Toward & Co., St. Lawrence, have for some time past been pretty busy, and there are as yet no indications of lessening work. In the iron founding business new orders are scarce, and forge proprietors find it difficult to keep even a portion of their plant in operation. Chain and anchor works are, for the most part very slack, but at the establishment of H. Charlton & Co., Gateshead, there are some large anchors being manufactured for a foreign government. Mr. W. F. Snowdon, of 32, the Side, has had, among recent contracts, the covering of the boilers and steampipes of the splendid passenger steamer *Midnight Sun*, which is to run during the tourist season between the Tyne and Norway. During the coming month Mr. Snowdon has several contracts of a similar kind to carry out, on vessels which have received their machinery at the Wallsend Slipway Works. Since the opening of a branch office and showroom in connection with the business of W. Reid & Co., at No. 1, Akenside Hill, it is understood that the demand for the firm's specialities, and particularly for the new automatic steam reducing valve, has been most satisfactory. Makers of ships' lamps, ventilators, &c., are far from being fully employed, and the same remark applies to compass and binnacle manufacturers.

Electric Lighting.—Messrs. J. H. Holmes & Co. continue to be very busy in shiplighting, and are now engaged in completing installations in several locally built steamers. It is understood that Messrs. Clark, Chapman & Co. have secured some orders for installations in oil carrying ships, now building on the North-East Coast. Messrs. Rowland, Barnett & Co., of the Walker Gate Volt Works, have opened branch offices and showrooms at No. 28, Dean Street, Newcastle. With a view to afford customers an opportunity of judging for themselves as to the manner in which work is executed, the firm have fitted a very complete electric lighting installation in the show-rooms.

THE WEAR

Shipbuilding.—So far as can be ascertained, only one order has been booked on the Wear during the past month, this being for a cargo boat of moderate size given to the Strand Shipbuilding Co., by a firm of local owners. The keel for this vessel is now laid, and frame turning will be commenced immediately.

At the North Sands yard, business is still very brisk, the whole of the five berths being occupied with vessels of a large class. The frame furnaces continue in full operation and large quantities of material from the various centres of the steel manufacture are being daily received. The locally owned steamer *Bellini* is now undergoing a pretty extensive overhaul at the firm's Manor Quay repairing works. Messrs. Blumer & Co. launched, on the 15th inst., a fine vessel ordered by Messrs. C. Hill & Co., of Bristol, and they have two other vessels in advanced stages of construction. At the Sunderland Shipbuilding Co.'s yard, and also at Messrs. Bartram & Haswells', there is a fair amount of work in progress, and at Messrs. S. P. Austin & Sons several repair contracts of importance have been dealt with lately. Messrs. R. Thompson & Sons' shipbuilding establishment at Southwick has been very slack for some time, there having been but one vessel on the stocks, the building of which had been temporarily delayed. There is now a better outlook however, as the work of the vessel referred to is to be proceeded with, and it is understood that frame turning for another vessel will be commenced shortly. The locally owned steamer *Remembrance*, is being repaired in the firm's Bridge Dock. At Mr. Laing's yard there are six vessels in progress, two of which are oil carrying boats, similar to four others that have been built in the yard during the last twelve months. The frame furnaces are still in operation and all appearances are indicative of a continuance of brisk work for some time to come. The Deptford Graving Dock which is connected with this old established shipbuilding yard is being enlarged with a view to the accommodation of a larger class of vessels than could have been admitted to the dock in its former state. About 70 ft. is being added to the length and about 20 ft. to the width of the dock, which will also be provided with more powerful working appliances than have hitherto been in use. There is every reason to expect that the enlargement of this graving dock will tend to greatly augment the number of repair contracts coming to the yard. At Messrs. W. Doxford & Sons' yard, matters have improved greatly since last month and quite a large force of men are now employed in the yard. There is now being prepared for launching at this establishment a vessel of the "whaleback" type, the design of which is, we believe, unique. Certainly there has never been another of precisely similar form built on the North-East coast. The vessel, which is of large dimensions, is cigar-shaped at both ends, while amidships the rounded shape is preserved so far as is consistent with stability and the provision of adequate hold space. On the deck a spacious superstructure is placed which will greatly add to the strikingly novel appearance of the vessel when in the water. Messrs. Doxford have already become noted for building some of the largest cargo boats afloat, and also for the new departure made by them last year, in designing and building the s.s. *Turret*; but it is not too much to say that the building of the vessel now referred to, will eclipse anything they have hitherto done in trying to keep pace with the spirit of modern progress so far as regards improvements in naval architecture. Messrs. Short Brothers continue to have a good supply of work in their yard, and are carrying out extensive repairs to the s.s. *Inflexible*, in the Cornhill Dock. Messrs. Pickersgill have only a small sailing-ship on the stocks, but at Messrs. Priestman & Co.'s yard there are three vessels in progress. Mr. John Wigham has a large repair contract in hand at his slipway, South Hylton, and active preparations are being made for the opening of the new shipbuilding yard at the same place. There appears to be a fair demand for vessels of a small class, and the firm who are about to commence the building of such vessels at South Hylton, will doubtless get a full share of such work as is to be had. In the ship's boat building trade, great slackness still exists.

Engineering.—The slackness in the marine engineering works (with one exception) has deepened considerably, and at some works short time has been there resorted to in preference to the more common practice of discharging hands. Even with this expedient, however, a great many operatives have necessarily been doomed to face the unpleasant alternative of absolute idleness, and appearances at the present time do not afford much promise of their early reinstatement. The exception referred to is Messrs. Doxford's establishment, where, owing to a recent accession of work, some hands have been taken on. In the smaller works there is little doing, Messrs. Lynn & Co. being, perhaps, the busiest of the firms who devote themselves exclusively to the manufacture of steering gears and steam winches. Iron works and forges are still short of work, and in the foundries very little in the way of improvement is to be noted. Chain and anchor manufacturers are only moderately employed, and rivet works are slack. Orders for Mills' boat gear have been very numerous lately, and the works at Monkwearmouth, where the gear is manufactured, are kept pretty busy. Among the orders to hand is one to supply a complete equipment of the gear to the large yacht building for Mr. Vanderbilt, at Birkenhead.

The Hartlepools.—Shipbuilders at the Hartlepools continue to have a fair share of work in their yards, though business is far from being as good as might be desired, it is still satisfactory when compared with the state of matters at some other centres. Since our last report several new steamers that have been engined at the Central Marine Works have left Hartlepool, and two that have been lying completed for some months, have also gone to sea. The most interesting event, however, to owners of old steamers, is the completion and sending to sea of the s.s. *Mark Lane*, a vessel whose old machinery has been altered at the Central Works, merely by reducing the diameters of the cylinders, and increasing the boiler pressure to a corresponding extent. This constituted a cheap method of bringing up the economy of the machinery to something like present day practice, and the vessel having now made a voyage, it must be interesting to those who hardly know what to do with their old engines, to learn that a reduction in coal consumption has been effected to the extent of from 20 to 25 per cent. This alteration was very carefully carried out to preserve a balance of power, and as a matter of fact, some of the diagrams that have been sent home during the first voyage, work out to precisely equal power on both cranks. The alteration included the fitting of a propeller of the special type made at the Central Works, for which a portion of the economical result is claimed. Although the engineering authorities at the Central Engine Works do not maintain that an engine so altered can be regarded as equal to a three-crank triple engine of the present day, they believe that in all probability this cheaper method of alteration will be very largely adopted in the renovation of old compounds, where the vessels are not of sufficient value to warrant the expenditure of providing new engines.

Stockton.—It is reported that Messrs. Ropner & Son have secured an order for four large steamers, and that work will soon be commenced upon the first of them. The yard has been slack for some time, and the firm have made use of the opportunity to alter the arrangement of the building berths, with a view to increasing their capacity.

The following vessels fitted with engines, &c., by Messrs. Blair & Co., have had their trial trips during the month of April:—The s.s. *Sidra*, built by Messrs. Irvine & Co., of West Hartlepool, for Messrs. Thos. Appleby & Co., of the same port, having engines with cylinders 23½ in., 39 in., 64 in., by 42 in. stroke. The s.s. *Caldy*, built by Messrs. Richardson, Duck & Co., of Stockton, for Messrs. Farren, Groves & Co., of London, having engines with cylinders 23 in., 38 in., 62½ in., by 42 in. stroke. The s.s. *Hannah M. Bell*, built by Messrs. Ropner & Sons, of Stockton, for Messrs. Stainthorpe, Kitching & Co., having engines with cylinders 23 in., 37½ in., 61½ in., by 39 in. stroke. The s.s. *Tees*, built by Messrs. Richardson, Duck & Co., of Stockton, for the Tees Union Shipping Co., Middlesbro', having engines with cylinders 16½ in., 27 in., 44 in., by 30 in. stroke. The engines for all these vessels are constructed to work at 160 lbs. pressure of steam and the trials were in every case highly satisfactory. The Stockton Malleable Iron & Steel Co. are just now very busy, having orders in hand from most of the leading shipbuilding and boiler making firms in the country, besides foreign orders of considerable importance.

Middlesbro'.—In addition to the work reported last month as having been obtained by Messrs. Raylton, Dixon & Co. an order for a large cargo boat has now been secured from Sunderland. The outlook for the remainder of the year is therefore very satisfactory, so far at all events as this yard is concerned.

Consett.—Full activity continues to exist at the steel plate mills and angle mills of the Consett Iron & Steel Co. It is understood that further extensions in some of the departments are contemplated.

Southampton Dock Improvements.—The London and South-Western Railway Co. have entered into a contract with Messrs. Abbot & Co., of Gateshead, and Sir William Armstrong & Co. for the supply of hydraulic cranes and capstans throughout the Southampton docks. At first 18 cranes and 11 capstans are to be erected, and the contract is to be completed within two years.

NORTH-WEST OF ENGLAND.

(From our own Correspondent.)

Barrow.—The shipbuilding and engineering trades of this district are in a much quieter position than for some time past, and there are no indications of improvement from any quarter. No new orders have been booked by Barrow builders during the month, and the enquiries which are to hand have not led to business, although there is some reason to believe that a few contracts are pending which are likely to be placed with local builders. There is, however, no considerable demand for new tonnage, and it is probable that with so much shipping lying idle, with cargoes so scarce, and with freights at such a low and unremunerative point, owners will be slow to place any new contracts. At the same time it is becoming more and more evident every day that much of the old class of shipping which is now lying up will not again be of any practical use in the trade of the future, and that its early break-up would be a source of advantage and profit to owners as forming the nucleus at any rate of modern craft and modern types of engines. The work in hand at the yard of the Naval Construction and Armaments Co. is rapidly being cleared away. Lord Ashburton's fine steam yacht has been launched, and there now remains on the stocks three steamers for the British and African Steam Navigation Co., the first of which is to be launched on the 31st of May. The company has completed the *Brancker*, the new and powerful sand dredger, built for the Mersey Dock Board, and she is now undergoing a series of what have already proved successful trials in Morecambe Bay. She will probably commence operations on the Mersey Bar in the course of a week or two, and there is reason to believe she will there be the means of removing at a very expeditious rate the great body of drifted sand which blocks the entrance to the river. A report of the experiments with the *Brancker* and of her work as a dredger will be given in a subsequent number of the Marine Engineer. In the mean time it is interesting to know that this powerful dredger has already shown her capacity of raising 4,000 tons of sand, &c., per hour, and to do this she has also had to raise a vast body of water which flows over the sides of the hoppers and leaves the heavy matter lifted in the hoppers. The Indian troopship *Warren Hastings* will probably be ready for delivery in the course of a month. The Naval Constructon and Armaments Co. are making a very satisfactory job of this steamer. She is to undergo several trials before she is despatched to India, but she will be absolutely finished before she leaves Barrow, with the exception of her armaments, which will be added at Bombay, when necessity arises for her use as a troopship. In the engineering and boiler-making departments of trade there is a very quiet condition of affairs.

Whitehaven.—No shipbuilding is being done at Whitehaven. The yard remains closed, and the many rumours which have been circulated about purchasers of the yard have up to now proved to be a *ruse*, and it seems improbable that with trade so quiet as at present, there will be any incentive on the part of enterprising shipbuilders looking for a new yard, acquiring the one at Whitehaven, although it is offered at an old song.

Workington and Maryport.—There is a steady business in the shipbuilding trades of Workington and Maryport, but it is only a small trade that is done here after all, but it has the merit of being regular, and is not generally influenced by the ups and downs of trade in the shipbuilding world.

Shipbuilding Material.—Local makers of steel shipbuilding material are still out of the market, and cannot compete with east coast and Scotch makers, who quote £5 5s. for plates against £5 12s. 6d. at Barrow. It seems remarkable that Barrow cannot compete in this trade, being right in the heart of a steel-making district, with hematite ore in abundance at the very doors of the works, but the fact remains, that other makers of steel use Spanish ore largely at as cheap a price as natural hematite, and they are also in the district of coal, but Barrow has an advantage in cheap facility in carriage to shipbuilding centres, and that ought to counterbalance any disadvantage on the other hand. It is doubtless a fact, however, that at most of the works where steel shipbuilding material is produced, the plant is modern and is augmented by almost every conceivable labour-saving facility which experience can suggest, and thus a cheap cost of production is assured.

THE MERSEY.

(From our own Correspondent.)

A CONTINUED absence of any improvement in the condition of trade generally throughout this district can only be reported, especially as regards all branches of the marine engineering and shipbuilding industries, and this applies also to the extreme depression in shipping property which has prevailed for so long past and to which, of course, is largely due the present unsatisfactory outlook of the marine engineering and shipbuilding trades. With regard to shipbuilding on the Mersey, there is no specially new feature to note beyond what we referred to last month, and much the same may be said with regard to marine engineering generally, the principal firms in the Liverpool district still reporting an absence of new work of any importance giving out, beyond work in connection with the refitting of boilers and the reconstruction of machinery, and even in this direction there is not so much doing. Here and there, machine tool makers have orders for special tools for marine work, and Messrs. Cunliffe & Croom, of the Broughton Ironworks, Manchester, have recently supplied a very massive and powerful plate edge planing machine, which can be adapted to plane up to 35 ft. at one stroke, and having open ends will admit any length of plate. The cramping girder is made of steel plate, box section, and the cramps, being under the bottom face of the girder, are under the control of the workman standing on the floor, and being only 18 in. apart, give secure cramping. Extension brackets fitted with anti-friction rollers are provided at the back of the machine to admit any width of plate. The traversing motion of the carriage, the turning over of the tool-box, and the down feed, are all automatic, and the length of stroke is instantly adjustable. The machine requires no attention after the plates are cramped into position, until they are finished, ready for uncramping, whilst in the general construction, due attention has been paid to give ample strength where required, and the bearing surfaces are all made extra wide. The firm have also supplied to a foreign government department a very ingenious machine for dealing with copper boiler stays; for cutting them from the rough bar, rolling them straight, centring, recessing the body for clearance, squaring the ends, and chasing both ends on the one machine, any or all the operations being available together or separate as convenient. This being a combined machine for all the operations required, a great saving of shop room is obtained over the ordinary arrangements where separate machines are employed for each operation, whilst a great saving in cost is also effected.

As another interesting item in connection with engineering, I may mention that the Ashbury Railway Carriage and Iron Co., Limited, of Manchester, have recently introduced quite a new process (Mallam & Schofield's patent) for manufacturing solid pressed steel or wrought iron boiler mountings, and I have had an opportunity of inspecting a number of specimens of this class of work which they have just completed, in all sizes, from small stand pipes with 2 in. diameter holes, up to large manholes for either land or marine boilers. These are manufactured by means of special tools in powerful hydraulic presses, and especially for large manholes this process of manufacture possesses very important advantages. It is, of course, well-known that the cut-out for the manhole is a weak point in a boiler, but the manholes turned out by Mallam & Schofield's patent process can be manufactured of almost any strength that may be required, which would be utterly impossible by any other method, so that they can be made to strengthen the shell of the boiler where it has been weakened by the cut-out. In addition, the stand pipes and manholes being all in one piece are a great advantage over those which have hitherto been made in sections rivetted together, and although this process has only very recently been introduced, these new stand pipes and manholes have been largely taken up by several engineers and boiler makers in the district.

In the general run of engineering, establishments continue only moderately off for work, heavy stationary engine builders being perhaps in a better position than other branches of the trade, some of the principal firms in the district having a considerable weight of work in hand. Machine tool makers, however, continue but very indifferently supplied with orders, and amongst boiler makers new work has not been coming forward quite so freely as of late. With regard to employment, the returns issued by the Trades' Union organization show the position to remain about stationary, so far as the number of out-of-work members is concerned, which may be taken to indicate that although

trade is showing no improvement it is not getting into any actually worse position.

In the iron trade there has been a continued further downward tendency in prices during the month, until they would almost seem now to have got to a point below which it is scarcely possible they can drop much further, as makers would almost of necessity have to consider whether the cessation of production would not be preferable to continuing business on an altogether unprofitable basis. There is still a weak tone in the market, but not so much disposition to sell for long forward delivery, as some of the merchants and dealers are already pretty largely oversold, and an anxiety is being shown about covering recent low sales. Lancashire makers have been quite out of the market, except where they have very low rates of carriage for delivery, their works' prices being about 40s. for forge to 41s. for foundry, less 2½, whilst works' prices for Lincolnshire, which is the cheapest iron now offering in this market, are as low as 34s. for forge, to 35s. and 35s. 6d. for foundry, less 2½, with the rate of carriage into this district about 5s. 6d. to 6s. per ton. Outside brands have been offering here at considerable under makers' quotations, and ordinary foundry Middlesbrough can be bought at about 41s. 10d. net cash, delivered Manchester, whilst for named brands, makers are very firm at 42s. 10d., net cash, delivered Manchester. In Scotch iron, makers have had to follow the underselling of merchants, and for Eglinton, prices have given way about 1s. per ton, makers' quotations for delivery at the Lancashire ports now being 43s. 6d. net, prompt cash, whilst Glengarnock can be bought through merchants at 45s., and makers are now open to sell at 46s. 6d. net, prompt cash, delivered.

In manufactured iron, there has been only a very slow, hand-to-mouth business doing, but makers' quoted prices have not given way to any appreciable extent, although here and there they are willing to entertain good specifications at rather lower prices. Delivered Liverpool or Manchester, Lancashire bars are still quoted at £5 10s. but specifications could in some cases be placed at 1s. 3d., and for some low class local bars at 2s. 6d., under this figure, whilst North Staffordshire bars range from £5 10s., to £5 12s. 6d. In other descriptions of manufactured goods, prices are about as last given, the Hoop Iron Makers' Association having at their monthly meeting decided to maintain list rates on the old basis, and local sheets remain at £7 to £7 5s., Staffordshire, £7 7s. 6d., to £7 10s.; hoops, £6 for random, and £6 5s. for special cut lengths, delivered in this district.

In the steel trade, business all through continues very quiet, and for raw material prices have shown a decided weakening tendency. For good foundry hematite, makers have not been quoting under 53s. 6d. to 54s., less 2½ delivered in this district, but they have been quite out of the market at these figures, as where any orders have been obtainable, lower sellers in the open market have been securing them. Common steel billets are offering freely at £4, with local makers taking £4 3s., and the best Siemens-Martin billets quoted at £4. 6s. 3d. for delivery in this district, but makers not firm at this figure. The best qualities of steel boiler plates have remained tolerably firm at £6 7s. 6d, as the minimum for delivery in this district, and makers not caring to book any very large quantities at this figure; but common steel plates are offered very low, unclassed brands being obtainable at £6 per ton, and common ship-plates at £5 10s. per ton, delivered in this district.

In the metal market, business has been very slow, owing to a general expectation that list rates for manufactured goods would have to follow the downward movement that has been going on in raw material; but so far makers have not altered their prices, and for delivery in this district they remain about as under:—solid drawn brass boiler tubes, 5¾d.; solid drawn brass surface condenser tube, 7d.; solid drawn copper tube, 7¾d.; brazed copper gas and steam tube, 7d.; brazed brass gas tube 6¼d., brazed brass machine tube, 6¼d.; brass wire, 5¼d; copper wire, 6¼d.; rolled brass, 5¼d.; sheet brass, 6¾d.; yellow metal bolts, 5¾d.; yellow metal condenser plates, 5¾d.; cast composition sheathing nails and spikes, 5¾d.; cast red metal sheathing nails and spikes, 7¾d.; wrought copper rivets, 8¼d.; wrought copper boat nails, 8¾d. to 9¼d.; wrought copper tacks, 11¼d. to 1s. 2¼d.; cut copper nails, 8d. to 9¾d. per lb.; and copper bolts, £61 per ton.

Business generally throughout the timber trade has been extremely quiet, and with stocks all round still more than sufficient for the demand, there is no improvement in values. There have been moderate arrivals of East India teak, but the consumption is only on a small scale. Stocks, however, are moderate, and values have been fairly steady. Of greenheart there has been also a moderate arrival, but as there is almost a complete absence of any requirements for consumption just at present, sales have been difficult to effect, even at much lower prices than have been ruling for some time past, and a heavy stock is now accumulating.

The coal trade is probably in a more depressed condition than has been known for a very considerable time past. All descriptions of round coal are in the most restricted demand possible, and although very few collieries have been working more than three to four days a week, stocks have been accumulating, in some cases to a large extent, and there is a general weakness and irregularity in prices that leads to very low figures being taken to effect sales. This is specially the case in the lower descriptions of round coal for steam and forge purposes, which can be bought at almost any price from 6s. per ton at the pit mouth, and in good qualities, suitable for locomotive purposes; the railway companies have been enabled to place contracts without difficulty at 6s. 3d. per ton at the pit mouth, which is quite a 1s. below the lowest price at which they were able to buy last year, whilst for shipment and for steamers' use excessively low prices are also ruling. Ordinary descriptions of steam coal, for delivery at the ports on the Mersey, can be readily bought at 7s. 6d. and 7s. 9d. per ton, whilst contracts for steamers' use have been taken at 1s. 6d. under the prices obtained last year. The depression in the round coal trade, and the consequent small quantity of slack just now being screened, is producing a scarcity of engine classes of fuel, which is rendering it difficult in many cases for consumers to cover requirements, and there is necessarily a hardening tendency in prices, which have advanced quite 3d. to 6d. per ton during the month. Good qualities of burgy are fetching about 6s. 3d. to 6s. 9d., best qualities of slack, about 5s. 3d. to 5s. 9d., with lower qualities averaging 4s. to 4s. 6d. per ton at the pit mouth.

HULL AND DISTRICT NOTES.

(From our own Correspondent.)

Hull.—The announcement of the termination of the Hull Dock Strike last week was received with the greatest satisfaction, and, although opinions may differ as to the various clauses of the agreement upon which the strike has been settled, there can be no doubt that an intense feeling of relief pervades all classes, that the prolonged and disastrous struggle has terminated. There is also a strong conviction that one effect of this bitter conflict between capital and labour must hasten the time when such struggles will be impossible, and that all trade disputes, in short, will be settled through the medium of a national court of arbitration, which should have compulsory powers.

Several orders have been placed during the last month for steam trawlers in this district. Messrs. Earle's have secured six of various sizes, and have also in hand some very extensive repairs on their six slipways—s.s. *Sheffield*, with bows "bashed in" after collision; s.s. *West Riding*, after stranding; p.s. *Adelaide*, for general overhaul, &c.

On May 4th Earle's Shipbuilding and Engineering Co. launched two new iron fishing vessels for the Pioneer Steam Fishing Co., Grimsby (Messrs. Moodys & Kelly, managers.) Their dimensions are:—93 ft. 6 in. by 20 ft. by 11 ft., depth of hold, built in excess of Lloyd's requirements for 100 A1 class. Engines also constructed by Earle's. Cylinders, 11 in., 17 in., 30 in., by 21 in. stroke, supplied by large steel boilers to work at 160 lbs. pressure. The vessels were named *Swallow* and *Thrush*.

The screw tug *Hercules*, for the Hull Dock Co., and the steam trawler *Queensland*, for the Hull Steam Fishing and Ice Co., both built by Messrs. Cook, Welton & Gemmell, and engined by Earle's Co., have been completed during last month.

The new first-class protected cruiser *Endymion*, 7,350 tons displacement and 12 guns, which has been built, engined, and completed by Earle's Shipbuilding and Engineering Co.—the christening ceremony of which, it may be remembered, was performed by the Marchioness of Salisbury—was taken on her official trial trip from Portsmouth Royal Dockyard on 5th ult., when a continuous run at full speed for eight hours was made in the English Channel, and the following most satisfactory results were obtained:—

Draught of water forward, 19 ft. 8 in. Aft, 22 ft.
Steam in boilers, 152 lbs.

		Starboard.	Port Engines.
Vacuum		27 in.	27·1 in.
Revolutions		99·6	99·3
Mean pressure.	High press. cyl.	45·81	45·32
	Medium ,,	24·7	28·57
	Low ,,	13·15	12·4
Mean I.H.P.	High press. cyl.	1477	1457
	Medium ,,	1732	1999
	Low ,,	2052	1929
		5261	5385

Total mean I.H.P., 10,646.

Mean air pressure only 0·17 in. Speed of vessel, 20·96 knots. Greatest revolutions on trial, 102. Indicating 10,868 H.P.

The speed was greatly in excess of what was anticipated, and the consumption of coal was also most satisfactory, being 1·6 lbs. per indicated H.P. per hour.

There was not a hitch throughout the whole of the day, and the machinery worked smoothly and regularly, causing much gratification to all concerned. Immediately after the boilers were cooled down, a thorough examination was made by the dockyard officials of all the shells and combustion chambers, including all the plain and stay tubes, stays, joints, seams, and rivets, when it was found that not one of the plain tubes had leaked even slightly, and in this case *no* cap ferrules were fitted, and the inspectors declared they had never examined a set of new boilers after trial in such good condition.

The *Endymion* is to be brought forward and prepared for the pennant, and to take part in the next naval manœuvres. She is the first contract-built vessel of her class that has gone through the official steam trials and with even better results than the dockyard-built cruisers *Edgar*, *Hawke*, *Royal Arthur* and *Crescent* (the latter only last week); the others to follow are the *Gibraltar*, *Grafton*, *Theseus* and *St. George*.

At the speed maintained on trial, the *Endymion* would have given the *Campania* a chase on her last voyage from New York, with a day's coal in her bunkers to spare. Your readers are doubtless aware that the much-talked-about *Gigantic*, the great triple-screw vessel which Messrs. Harland & Wolff were said to have received an order for from the White Star Line to lick creation, is all wrong; there is no such vessel building there or anywhere else; but, little by little, the details of the two new cruisers, *Terrible* and *Powerful*, to be built by contract, are leaking out, and it is evident that, when completed, they will be the envy of the other naval Powers. They are to have engines of 30,000 H.P., equal to the *Campania*, and they are to travel at the rate of 25 knots an hour. The dimensions are said to be 500 ft. by 70 ft.; they will thus have beam enough to enable them to carry a powerful armament, while the proportion of length to beam ensures a capacity to maintain their high rate of speed.

In the "Notes" for April last, it was pointed out that the Navy Boiler Committee had finished its work, and their investigations, along with the evidence of the various witnesses, had been printed in Blue-Book form—marked confidential—since then the "conclusions" and "recommendations" of the Committee have been published, after repeated refusals to do so.

The members of the Committee appointed by the Lords Commissioners of the Admiralty (March, 1892), were as follows:—Alex. Butler, Vice-Admiral and Chairman; John H. Hoffeman, R.N.; W. Castle, R.N.; J. T. Corner, R.N.; Peter Samson, Board of Trade; James T. Milton, Lloyd's Registry; Geo. W. Manuel, P. & O. Co.; Robert Humphrys, Humphrys, Tennant & Co.; H. J. Oram, R.N., Secretary.

The "reference" sent to witnesses for their observations was nearly as follows:—

1. Proportions of machinery and boilers recommended not only for short periods at full power, but proportions also for continuous steaming at sea.
2. Experience as regards bi-compound and tri-compound engines.
3. Details of boilers, tubes, diameter, pitch, &c., for all classes of war ships recommended.
4. Particulars of merchant vessels' machinery that gives satisfaction.
5. Feed heaters, any economy, &c.
6. Machinery specifications of Admiralty, any complaints?
7. Use of salt water for feed "make up." How much make up required on merchant steamers?
8. Opinions as to speed at which naval engines run.
9. Any experience with tubulous boilers?
10. Any greater trouble with high-pressure steam than with low?
11. Opinion as to cause of leaky tubes.
12. Space allowed in warships for machinery.
13. Coal consumption in merchant vessels.

Engineers will doubtless be surprised to find the outcome of such a talented committee—after twelve months' deliberations—including minority reports of three of their number, compressed into only ten pages of a Blue Book, and so far as expecting to find any real useful information, the reader may well content himself by simply reading the marginal references.

The absence of Mr. Robt. Humphry's name, of *Thunderer* fame, is rather conspicuous, especially when the evidence of the witnesses who appeared before him has been suppressed. If that gentleman had good reasons for declining to sign the main report, he might have favoured his profession with another minority report, which doubtless would have been much appreciated, especially by other contractors, seeing he was the only one of their class honoured with a seat on the committee—indeed, it is perhaps not too much to say that commercial experience as an engineer combined with his theoretical and practical knowledge, entitled his opinions to greater weight from his having felt the responsibility of his own work, a responsibility, it might be remarked, that few, if any surveyors, either under the Board of Trade or Lloyd's, have even had a chance to experience, and which many superintending engineers and overseers, who know nothing of science, are fond of *dabbling* with by adding a bit here or a bit there, after the specifications and plans are completed, not so much for efficiency, but rather to appear something—as they think—in the eyes of their employers, a practice which is discouraging alike to manufacturers, skilled draughtsmen and others, who may have taken great care in calculating the various parts for uniformity of strength of the whole construction.

Mr. Samson, of the Board of Trade, while *fully* concurring with the committee's report, is strongly of opinion that all boilers intended for use in H.M. Navy should be tested by water to twice the intended working pressure, and that the scantlings, stayings, &c., should be such that no part thereof would be unduly strained when subjected to the test, otherwise Mr. Samson apparently agrees with Admiralty practice, such as cast steel girders for supporting tops of combustion boxes, fire-worked portable steel stays, &c.

In the absence of evidence no one can tell how far the various casualties of late might have been prevented; but we have never heard of an explosion occurring in a marine boiler without proof afterwards being found of either faulty design, construction, workmanship, or inherent weakness, and which has been so clearly proved in each one of the following explosions, viz.—*Winslow* (which caused the introduction of shield or baffle plates), *Benbow*, *Rennon*, *Muscovite*, *Propontis*, *Prince of Wales*, *Britannia*, and last but not least, H.M.S. *Thunderer*, and although the inquiry in this latter case ended as it did, yet it had the immediate effect of drawing the attention of the Admiralty to other causes of weakness in flat surfaces in the uptakes of similar boilers where corrosion is most rapid and subject to weakening influences from the great heat they have to bear.

Mr. Manuel's remarks about too much material being bored out of the centre of main and crank shafts are rather vague without any reference to their outside diameter. Are there any hollow shafts in the P. & O. fleet? If so, the Board of Trade had better add another formula to their collection, based upon Mr. Manuel's experience. Their first formula (about twenty years ago) was brought about by the repeated failures of the small shafts of s.s. *Atrato*, and which undoubtedly had the effect, *then*, of producing some uniformity of practice and preventing so many failures of shafts at sea.

Steamers for the Amazon.—Messrs. Murdoch & Murray, shipbuilders, Port-Glasgow, have secured a contract to build a steel twin-screw steamer for the River Amazon passenger service. This is the fourth steamer of this class which Messrs. Murdoch & Murray have contracted to build within the past six months—one is nearing completion, and the keels of the other two will be laid down soon. The machinery in each case will be on the triple-expansion principle of 600 H.P., and will be supplied respectively by Messrs. David Rowan & Son, Messrs. Lees, Anderson & Co., and Messrs. Kincaid & Co.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Zodiac.—On April 27th Messrs. Joseph L. Thompson & Sons launched at Sunderland a steel screw steamer, built to the order of Messrs. Turner, Brightman & Co., of London, of the following dimensions, viz.: —Length over all, 324 ft.; breadth, extreme, 41 ft.; depth, moulded, 23 ft. 2 in., having a deadweight carrying capacity of about 4,300 tons, and built under special survey for the highest classification at Lloyd's. The engines, by Mr. John Dickinson, are of the triple-expansion type, with cylinders 24 in., 39 in., and 64 in. diameter respectively, with a stroke of 42 in. The vessel was named the *Zodiac*.

Penarth.—On Saturday, April 29th, Messrs. William Gray & Co., Limited, launched the large steel-screw steamer *Penarth* which they have built to the order of Messrs. Morel Brothers, of Cardiff. The vessel will take Lloyd's highest class, and is of the following dimensions:—Length over all, 335 ft.; breadth, 42 ft. 6 in.; depth, 23 ft. 1 in. The deck erections consist of a poop, long-raised quarter-deck, forward of which the vessel is awning-decked. A handsome saloon and state-rooms together with the captain and officers' rooms will be fitted in the poop. The hull is built with web-frames, and double bottom under each hold for water ballast. Large hatchways are fitted, steam winches, steam steering-gear amidships, and screw gear aft, patent direct steam windlass by Emerson, Walker & Co., two donkey boilers, shifting boards throughout, boats on beams overhead; stockless anchors, and a complete outfit will be fitted for a first-class cargo boat. Fine engines on the three cylinders triple-expansion principle are being supplied by the Central Marine Engine Works of Messrs. Wm. Gray & Co., Limited. They will develop over 1,200 H.P. The cylinders are 24 in., 38 in., 64 in. diameter, with a piston stroke of 42 in., and five large steel boilers having a pressure of 160 lbs. per square inch will give an ample supply of steam. The construction of the ship and machinery have been built under the superintendence of Mr. F. Good on behalf of the owners, and the ceremony of christening the steamer *Penarth* was gracefully performed by Miss Evelyn Baines, of West Hartlepool.

Egyptian.—On May 1st there was launched from the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesbrough, an iron steam trawler of the following dimensions:—Length, 100 ft. 8 in.; beam, 20 ft. 5 in.; depth, moulded, 11 ft. 8 in., which has been built to the order of the Great Grimsby Albion Steam Fishing Co., Limited, of Grimsby. She is of the well-known type of steam fishing vessels by these builders, and is the fifth which they have built for the same owners. Triple-expansion engines will be fitted by the North Eastern Marine Engineering Co., Limited, of Sunderland, the cylinders being 11 in., 17 in., and 28 in., by 21 in., with a large steel boiler working at 160 lbs. pressure. As the steamer was leaving the ways she was named the *Egyptian* by Mrs. R. Atkinson, of Grimsby.

Roland.—On May 1st there was launched by Messrs. Sir. W. G. Armstrong, Mitchell & Co., on the Tyne, a steel screw steamer for the Norddeutscher Lloyd of Bremen, and intended for their new *Roland* line between Bremen and New York. The principal dimensions of the vessel are:—Length, 357 ft.; breadth, 43 ft. 9 in.; depth, moulded, 28 ft. 3 in. The vessel was named *Roland*, and after the launch was taken to the works of the Wallsend Slipway and Engineering Co., where she will be fitted with triple-expansion machinery.

Scawsby.—On May 2nd there was launched by Messrs. S. P. Austin & Son, at the Wear Dockyard, Sunderland, the steel screw steamer *Scawsby*, of the following dimensions:—Length, 290 ft.; breadth, 41 ft.; depth, 21 ft. 6 in.; gross tonnage about 2,400 tons; to be classed 100 A1 in Lloyd's register; built under special survey. Triple-expansion machinery will be supplied by Messrs. Geo. Clark, Limited, of Southwick Engine Works.

Carib Prince.—On May 3rd Messrs. Short Brothers launched at Pallion, Sunderland, a steel screw steamer built to the order of Mr. James Knott, of the Prince line of steamers, Newcastle-on-Tyne. The vessel is constructed of Siemens-Martin steel to the highest class on the spar deck grade in Lloyd's register. The dimensions are as follows:—Length, 295 ft.; breadth, 37 ft.; and depth, 25 ft. Fitted with patent direct steam combination windlass by Emerson, Walker & Co. The vessel was named *Carib Prince*. The engines are to be fitted by Messrs. Blair & Co., Limited, of Stockton, having cylinders 22 in., 36 in., and 59 in. diameter, with 39 in. stroke.

Valiant.—On May 3rd the new steel twin-screw yacht *Valiant*, built by Messrs. Laird Brothers, for Mr. W. K. Vanderbilt, of New York, was launched at Birkenhead. She has been built from the designs of Mr. St. Clare Byrne, of Liverpool, who designed the *Alva*, which was run into and sunk last year, with modifications recommended by Messrs. Laird. Lady Mary Alva Montagu performed the christening ceremony. The principal dimensions of the vessel are:—Length between perpendiculars, 310 ft.; extreme beam, 39 ft. 3 in.; depth, 25 ft. 6 in.; and tonnage about 2,400 tons. The hull is of steel, subdivided by watertight bulkheads, and fitted with a cellular bottom, arranged to carry water ballast. Teak is used for the upper deck and rails, and also for sheathing the deck-houses and bulwarks. She will have two sets of triple-expansion engines, driving manganese bronze screws. They are intended to indicate about 4,500 H.P., which will insure on trial with moderate forced draught a speed of fully 17 knots, whilst under natural draught the vessel will steam 15 knots. The *Valiant* will be fitted with all the most modern improvements, including electric light and two powerful search lights. After the launch the vessel was taken up to the float, where the two main boilers will be put on board, and the vessel will then be placed in dry dock for completion.

Lantana.—On May 3rd the steam yacht *Lantana*, designed and built by Day, Summers & Co. for Mr. Matthew Cope, of Cardiff, was launched at Southampton. The principal dimensions are:—Length over all, about 148 ft.; length between perpendiculars, 125 ft.; length on load water line, 121 ft. 6 in.; breadth, moulded, 19 ft.; depth at centre, 12 ft. 6 in.; tonnage, builders' measurement, 218; tonnage, yacht measurement, 203; tonnage, gross register, 164; tonnage, net register, 111. Built of steel to Lloyd's 100 A1 class, with cutwater stem and handsome scroll figure-head and trail board, square stem with quarter badges. The engines are of the compound surface condensing type, with cylinders 15½ in. and 30 in. in diameter, and 23 in. stroke. The boiler is of steel 9 ft. 10 in. in diameter, and 8 ft. 9 in. long. Working pressure, 100 lbs. The bunkers hold nearly 50 tons of coal, exceptional capacity for size of vessel. The yacht has a steam windlass. The whole of the owner's accommodation is situated abaft the engine room, and consists of a saloon, four state rooms, ladies cabin, bath-room, &c., and the entrance is from a large deck-house aft, containing the dining-room, pantry and staircase.

Satanita.—On May 3rd Messrs. Fay & Co., of Southampton, launched this yacht, which is said to be the largest racing cutter ever built in the kingdom. The dimensions which follow are only approximate:—Length over all, 130 ft.; beam, 24 ft. 6 in.; draught of water, 15 ft. She has been built to the order of Mr. Arthur D. Clarke.

Swallow and Thrush.—On May 4th Messrs. Earles' Shipbuilding and Engineering Co., Limited, Hull, launched two finely modelled iron trawlers, named the *Swallow* and *Thrush*, for the Pioneer Steam Fishing Co., Limited, of Grimsby. Their dimensions are 93 ft. 6 in. long, 20 ft. beam, and 11 ft. depth of hold, and they are built to much heavier and stronger scantlings than required by Lloyd's for their 100 A1 class. They also have the latest and most improved appliances for fishing purposes, including one of Messrs. Earles' 6 by 10 special steam trawling winches, and patent trawler windlass by Emerson, Walker & Co. The engines, made by the same firm, are of the triple-compound type, of 45 N.H.P., with a large boiler to work at 160 lbs. steam pressure.

Sir Frederick.—On Thursday evening, May 4th, there was launched from the Falmouth Docks Iron Works, in the presence of a large number of spectators, a splendidly modelled composite steam tug, built and engined by Messrs. Cox & Co. for the Associated Boating Co. of Port Elizabeth, South Africa. There was a stage with ascending stairs erected at the bows of the vessel, on which were Mrs. and the Misses Searle, the wife and daughters of Mr. Searle, one of the leading owners, who are at present residing at Falmouth, also members of the firm of Cox & Co., and other friends. At 7 p.m., to the minute, the dog shores were knocked out, and the vessel being christened the *Sir Frederick* by Miss Lizzie Searle, immediately glided smoothly into the sea, amidst the cheers of the onlookers. The vessel is 105¾ ft. by 20½ ft. by 12 ft. and is of the strongest and most complete description, her fastenings being gun metal bolts tapped

into the frames and with nuts also, and her decks of teak, &c. The engines are triple-expansion, 12½ in., 19½ in. 32 in., by 27 in. stroke, supplied with steam from a steel boiler to work at 160 lbs. per square inch. She is also fitted with Napiers' patent steam windlass forward, and steam capstan aft by the same firm. At the stern there is a special arrangement for taking heavy anchors and chains on board.

Westmeath.—There was successfully launched, on Monday afternoon, May 15th, from the Cast Yard of the firm of Messrs. C. S. Swan & Hunter, shipbuilders, Wallsend, an exceptionally large and beautifully modelled steel screw-steamer, of the spar-deck type. The vessel, which measures 435 ft. in length, 53 ft. in breadth, with a moulded depth of 34 ft., is constructed on the cellular double bottom principle throughout, her after peak also being fitted with water ballast arrangements. She has been built under special survey, and is classed 100 A1 at Lloyd's. She has also been built under the Board of Trade survey for passengers, and accommodation for thirty first-class will be fitted in large cabins under the bridge, a handsome saloon occupies the forward end. The Admiralty requirements having been carried out, she will doubtless be put on the list as a transport. She has a long poop, long bridge, and topgallant forecastle, all the latest improvements in naval architecture being introduced into her deck machinery, nine special winches, and cargo whips being fitted to facilitate the rapid loading and discharging of cargo, which will be effected by means of specially arranged derrick posts, placed at the sides of the hatches instead of by derricks on the masts. The accommodation for the crew includes separate bath, mess and reading rooms for the firemen and sailors. She has been designed to maintain a speed of eleven knots when fully laden. Her engines have been built by the Wallsend Slipway and Engineering Co., Limited, the cylinders being 31 in., 50 in., 80 in., and 54 in. stroke. Steam will be supplied by three double-ended boilers, 16 ft. 6 in. long, by 13 ft. 6 in. diameter, working at a pressure of 160 lbs., and fitted with Messrs. John Brown & Co.'s patent Serve tubes. Mr. W. L. Byers, of Sunderland, has supplied her with his patent Reliance anchors. Her deadweight capacity with Lloyd's freeboard will be 8,700, her measurement capacity, excluding bunkers, upwards of 11,000 tons of 40 cubic feet, thus constituting the vessel as the largest deadweight measurement carrier ever built on the river Tyne. On leaving the ways, this magnificent vessel was named the *Westmeath* by Miss Freda Hudson.

Adjutant.—On Tuesday, May 16th, Messrs. Wm. Gray & Co., Limited, launched a fine steel screw steamer of the following dimensions, viz.:—300 ft. length overall, 39 ft. 6 in. breadth of beam, and 21 ft. 4½ in. depth, built to the order of the General Steam Navigation Co., of London. The vessel, which will take Lloyd's highest class, is of the well-decked type, with a poop containing the saloon and cabins, long raised quarter-deck, long bridge having the engineer's accommodation at the after end, and top-gallant forecastle fitted up for the crew. The hull is built on the web-frame principle, with cellular double bottom throughout, large hatchways are fitted, four steam winches, steam steering gear amidships and screw gear aft, donkey boiler, boats on beams overhead, and everything complete will be provided for general trading. The Central Marine Engine Works of Messrs. William Gray & Co., Limited, supply fine triple-expansion engines, having cylinders 22 in., 35 in., and 59 in. diameter, with a 39 in. piston stroke, and two large steel boilers to work at 160 lbs. pressure per square inch. The christening ceremony was gracefully performed by Mrs. G. Smith, of Bonnington, Edinburgh, niece of Sir William Gray, and the steamer named *Adjutant*. The arrangements and building of the ship have been under the superintendence of Captain Ellis, on behalf of the owners.

Beltisloe.—On May 17th Furness, Withy & Co., Limited, launched from their yard at Hartlepool, a large steel screw steamer, built to the order of Messrs. Bennetts & Co., Grimsby. She is a fine type of a modern cargo boat, measuring over 320 ft. in length, and built throughout of Siemens-Martin steel, with a large measurement and deadweight capacity, and built to the highest class at Lloyd's. The vessel has a long raised quarter-deck, short poop, long bridge-house, and a top-gallant forecastle. The holds are fitted with iron grain divisions, and all decks, deck erections, skylights, bulwarks, bulkheads, etc., are constructed of steel and iron. Cellular bottom fitted all fore and aft for water ballast. The greater portion of the plates are in 24 ft. lengths, making the structure of the ship very strong. Four steam winches, one donkey boiler, patent steam steering gear amidships, screw gear aft, direct steam patent windlass, stockless anchors, hauling into hawse pipes, and other modern appliances are fitted for the handy working of the vessel. The saloon and cabin providing accommodation for the captain, etc., is handsomely finished in polished hard-wood, with painted panels, executed in an effective style by the staff of ladies employed by the firm. The steamer will be rigged as a two-masted fore and aft schooner; and has been constructed under the personal supervision of Mr. Squires. She will be fitted with triple-expansion engines by Messrs. T. Richardson & Sons, Hartlepool. On leaving the ways she was gracefully christened *Beltisloe* by Mrs. W. R. Page, of Southampton.

Stolzenfels.—On May 18th there was launched from the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesbrough, a finely modelled steel screw steamer of the spar-deck type, which has been built to the order of the Deutsche Dampschiffahrts Gesellschaft Hansa of Bremen, under the superintendence of Mr. D. Wulff. The principal dimensions are:—Length, 327 ft., beam, 41 ft., depth moulded, 29 ft., with a large deadweight carrying capacity as well as special arrangements fitted for the particular trade of the owners. The spar-deck is of steel sheathed with teak, and web frames are fitted instead of hold beams. Engines will be fitted by Messrs. Thomas Richardson & Sons, of Hartlepool, the cylinders being 24 in., 38 in. and 64 in. by 42 in., with large boilers working at 160 lbs. pressure, which have been designed to comply with the law of Germany as well as the requirements of Lloyd's. As the steamer was leaving the ways she was named the *Stolzenfels* by Miss Madeline Garlike, of Ipswich, Suffolk.

Venetia.—On May 18th a handsome steam yacht, built to the order of Lord Ashburton, was launched from the yard of the Naval Construction and Armaments Co., Barrow, named the *Venetia*. The launching ceremony were performed by the Hon. Miss Hood, daughter of Viscount Hood. There were also present on the occasion Lord Ashburton, the Earl of Crawford and Balcarres, Kt., LL.D., F.R.S., Lord Deerhurst, Sir Henry Edwardes, Mr. W. C. Storey, M.I.N.A., London; Captain Caws (who will take command of the *Venetia*); Mrs. Hamilton, Mrs. Gowan, Mr. Alexander Adamson (Managing Director of N. C. & A. Co.); Mr. Gowan (Shipyard Manager N. C. & A. Co.), and several others. The vessel has been designed and built under the superintendence of Mr. W. C. Storey, M.I.N.A., London. She is constructed of steel, &c., to Lloyd's highest class, and is divided into seven watertight compartments, to main deck. The principal dimensions are as follows:—Length over all, 258 ft. 6 in.; length on water-line, 221 ft.; breadth, moulded, 29 ft.; depth, moulded, 20 ft.; tonnage, Thames yacht measurement, 950 tons. On the main deck two large deck-houses are built, the forward house containing reception-room, chart-room, kitchen, &c. The aft house will be fitted up as a music room, the top of forward house forming a promenade and bridge deck. The accommodation on the lower deck comprises dining-room, drawing-room, state-rooms, lavatories, baths, &c. Aft on this deck, cabins are arranged for captain, officers, and servants. Forward on the lower deck the crew and firemen are berthed. The hold below the lower deck is entirely fitted with store-rooms, fresh-water tanks, sail-rooms, officers' and crew's baths, w.c.'s, &c. Electric light will be fitted throughout. The yacht will be rigged as a two-masted fore and aft schooner, and will carry six boats as well as a steam launch; a number of quick-firing guns will also be mounted. She is provided with steam windlass, steam capstan, steam and hand-steering gear, and hand-mast winches. The vessel will be propelled with a set of direct-acting inverted triple-expansion engines, having cylinders 21½ in., 34 in., and 56 in. diameter, and 34 in. stroke. The steam will be supplied at 160 lbs. pressure from two single-ended boilers, each 10 ft. 6. in. long, and 14 ft. 6 in. diameter. A donkey boiler for working deck machinery will also be fitted.

United.—On May 18th Messrs. Richard & Henry Green launched from their yard at Blackwall a twin-screw tug for and built to the order of Messrs. Wm. Dunn & Co., 43-54, Broad Street Avenue, London, for service at East London, Cape of Good Hope. On leaving the ways the vessel was named *United* by Mrs. Dunn. The principal dimensions of the vessel are:—Length, 108 ft.; breadth, 21 ft.; and depth, 12 ft. Two sets of engines of the compound direct-acting surface-condensing type to indicate 625 H.P., with cylinders 15½ in., and 13½ in. diameter,

by 21 in. stroke, will be fitted by Messrs. Alex. Wilson & Co., Limited, Vauxhall Ironworks, Wandsworth Road. A steam winch and a windlass driven by messenger chain are provided, specially adapted for picking up large cables.

Boston City.—On May 18th there was launched by Messrs. John Blumer & Co., at Sunderland, the screw steamer *Boston City*, which has been built to the order of Messrs. Charles Hill & Sons, Bristol. Her dimensions are:—Length over all, 306 ft.; breadth, extreme, 39 ft.; and 25·9 ft. moulded depth. The vessel is specially designed for the New York trade. The engines are being constructed by Messrs. Blair & Co., Stockton, having cylinders 23½ in., 39 in., and 64 in., with a stroke of 42 in. The boilers are of steel, having a working pressure of 160 lbs. per square inch.

Cimbria.—On May 20th there was launched from the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesborough, a very finely-modelled steel steam trawler and fish carrier, which has been built to the order of Danish owners, and the vessel will be completed under the superintendence of Captain Solling. The principal dimensions are:—Length, 145 ft. 6 in.; beam, 21 ft. 6 in.; depth, moulded, 12 ft. 4 in. In addition to the permanent iron dross ballast, arrangements are provided for using the after-peak tank for water ballast, for the purpose of trimming the vessel under varying conditions. A full outfit will be supplied, including steam trawl winch, dandy scores, revolving bollard, &c. Engines will be fitted by the North-Eastern Marine Engineering Co., Limited, of Sunderland, the cylinders being 14 in., 22 in. and 35 in. by 24 in. stroke, with one large steel boiler working at 160 lbs. pressure. As the vessel was leaving the ways, she was named the *Cimbria*, by Mrs. Anna Johansen.

Golden Wedding.—On May 20th there was launched from the shipyard of Mr. William Caisley, Howdendyke, a sailing vessel, built to the order of Mr. G. Kilner, of Thornhill Lees, near Dewsbury. She is built of oak, and is 120 ft. long, with a beam of 27 ft. 6 in., and a depth of hold of 12 ft. 9 in. The vessel was named the *Golden Wedding*.

LAUNCHES—Scotch.

Yarrow.—On April 27th Messrs. R. Napier & Sons launched from their shipyard at Govan a handsome steel screw steamer, which has been built to the order of Messrs. William Sloan & Co., Glasgow. The vessel has been specially designed for service between Silloth and Dublin, calling *en route* at Douglas, Isle of Man. She is built to class A1 100 at Lloyd's, and R.S.* with the British Corporation, but her scantlings are considerably in excess of the requirements of either register. Her dimensions are:—Length of keel and forerake, 230 ft.; breadth, 32 ft.; depth of hold from main deck, 14 ft. 10 in. She has a long poop, bridge, and topgallant forcastle, and there are very superior quarters for about 70 first-class passengers. She will be able to carry about 456 head of cattle. To maintain a high rate of speed the machinery consists of a set of triple-expansion engines, with two boilers for a working pressure of 165 lbs. There will be a complete installation of electric light, and all the most recent appliances for the safe navigation of the ship and the rapid handling of cargo. Mrs. George Sloan cut the lashing that held the steamer, and named her the *Yarrow*, and after a most successful launch the vessel was towed up the harbour to receive her machinery, which has been constructed at the builders' Lancefield works. The *Yarrow* is expected to be ready for her station by the beginning of June, and should prove a highly popular steamer for passengers travelling between Scotland and Ireland.

Saga.—On April 28th a new steamer named the *Saga* was launched from Messrs. Copeland's patent slip. The vessel, which is 63 ft. in length, is built from plans prepared by Mr. W. S. Baikie, and is engined by Messrs. Simpson, Strickland & Co., of Dartmouth. The *Saga* is intended for the South Isles trade, and will carry the mails from Stromness to Graemsay, Hoy, Longhope, Flotta, and Pharay.

Cleopatra.—On April 29th there was launched from the yard of Messrs. Ramage & Ferguson, Limited, a steam yacht of about 650 tons, built to the order of John Lysaght Esq., St. Vincent's Iron Works, Bristol, and designed by Mr. G. L. Watson. This is the fourth yacht built by the above firm for Mr. Lysaght, her principal dimensions being 185 ft. by 27 ft. 6 in. by 18 ft. moulded depth. She is fitted with triple-expansion engines having cylinders 18 in., 29 in. 47 in., by 33 in. stroke, supplied with steam from a large single-ended steel boiler, working at 160 lbs pressure. The cabin arrangements are very complete and elegant, being fitted to special designs in rare polished woods, while all other conveniences and appliances are of the latest and most improved description. On leaving the ways, the yacht was named *Cleopatra* by Mrs. Gage, wife of Captain Gage of the 14th Hussars, and daughter of the owner.

Valkyrie.—On April 29th Messrs. David & William Henderson & Co. launched from their yard at Meadowside, Partick, the composite cutter *Valkyrie*, which they have built for Lord Dunraven from designs by Mr. G. L. Watson. The vessel, as is well known, is to represent this country in the forthcoming race for the America Cup. She will be sailed by Captain Cranfield. She is handsomely fitted on a plan similar to that followed in the construction of the Prince of Wales's yacht *Britannia*, which was launched from the same yard last week.

Croft.—On April 29th Messrs. David J. Dunlop & Co., engineers and shipbuilders, Port-Glasgow, launched at high water, a steel twin-screw steamer for the Royal Niger Co., Chartered and Limited, London. The vessel has been built under Board of Trade survey, and is of the following dimensions:—Length, 204 ft.; breadth, 35 ft.; depth, 15 ft.; with a gross tonnage of about 800 tons. She has been specially designed for ight draught service, and for the purpose of carrying palm oil on the West Coast of Africa. Her outfit consists of Harrison's steam steering gear, Charles Chapman & Co.'s improved steam windlass, winches, and warping capstan. The vessel is being supplied by her builders with two sets of triple-expansion engines, 11 in., 18 in., 28 in. diameter, by 27 in. stroke. As the steamer left the ways she was named the *Croft* by Miss Dunlop, Athole Place, Glasgow.

Calluma.—On May 1st Messrs. A. & J. Inglis, of Pointhouse, Partick, Glasgow, successfully launched the large cutter *Calluma*, and on the 3rd she left the yard complete. Her keel was laid on the blocks on February 27th, just nine weeks ago. The two other large yachts building in the neighbouring yard, although ordered earlier, have not yet been completed. In regard to her principal dimensions, the *Calluma* differs but little from the Prince of Wales's cutter *Britannia*, and Lord Dunraven's *Valkyrie*, her length on the water-line being about 86 ft., and beam about 22 ft. The *Calluma* will, however, be the longest of the three over all in consequence of her having great forward overhang. The *Calluma* is what is known in America as a "ballast fin" boat, and she showed a very sightly top when afloat. She has been built from a design by Mr. W. Fife, jun., of Fairlie, N.B., for a syndicate of Clyde yachtsmen, of which Mr. P. Donaldson will be the responsible owner. The *Calluma* is the first challenger for the Cape May cup. She is no mere shell, but is comfortably fitted below for cruising; in fact, she has everything a cruiser requires.

Alida.—On May 1st, Messrs. Russell & Co. launched at Port-Glasgow a steel sailing barque named *Alida*. Before leaving the stocks she was fully rigged, sails bent, and ballasted, with crew on board. She has been built to the order of Messrs. Petersen, Honeyman & Co., Glasgow, and is a vessel of 380 tons to carry 690 tons.

Dragon.—Messrs. W. Fife & Son, Fairlie, have lately launched the new 20-rating cutter *Dragon*, built to the order of Mr. F. C. Hill. The new *Dragon*, the third yacht of that name and size which Mr. Hill has had built for him at Fairlie, is a composite boat of the latest pattern. Her frames are mostly o nickel steel, while she is planked with elm and pitch pine below, and with mahogany on the top sides. She is fully coppered. Her keel is the nearest approach to a bulb which has as yet been tried on a boat of any considerable size.

Delaware.—On May 2nd there was launched from the shipbuilding yard of Messrs. David J. Dunlop & Co., engineers and shipbuilders, Port-Glasgow, the s.s. *Delaware*, built to the order of the Anglo-American Oil Co., Limited, London, for carrying petroleum oil in bulk, for which the vessel has been specially designed, being divided by strong thwartship bulkheads into ten oil-tight compartments, which are again subdivided by a longitudinal bulkhead in the middle line of the vessel, these compartments have all been separately tested in the presence of the owners and Lloyd's surveyors, and under

the most severe pressure to which the bulkheads will ever be subjected, each compartment proved itself thoroughly satisfactory. At the forward and after-end of the oil compartments is a 4 ft. well, extending the full breadth of the vessel and carried up to the height of the spar deck, the wells also satisfactorily stood the same test as applied to each oil compartment. The fore-hold, fore-peak and after-peak, and tanks under the engines and boilers (the latter built on the cellular principle) are all arranged for carrying water ballast for trimming purposes. The *Delaware* is fitted with all the latest improvements to suit her special trade, including Clarke Chapman's combined steam capstan windlass, steam warping winches, Brown Brothers steering tiller and telemotor, electric light fittings throughout by Holmes, of Newcastle. The accommodation and all appliances on board the vessel have been specially arranged to give the utmost comfort and facilities for the trade in which she is to be engaged. On leaving the ways the ceremony of naming the steamer *Delaware* was gracefully performed by Mrs. John D. Jamieson. The dimensions of the *Delaware* are as follows:—Length, 345 ft.; breadth, 44 ft.; depth moulded to spar deck, 31 ft. 6 in.; gross tonnage about 4,000 tons and classed 100 A1 in Lloyd's registry. The construction of the *Delaware* has been under the direct superintendence of Mr. Blair, chief superintendent, and Mr. McEwen, local surveyor, acting for the Anglo-American Oil Co., Limited. Immediately after the launch the *Delaware* was towed under the builder's 60 ton derrick crane at their wet dock to receive her machinery and boiler. The machinery consists of a set of triple-expansion single-screw engines, having cylinders 27 in., 43½ in., 70 in. diameter, by 51 in. stroke, fitted with Brown's patent steam and hydraulic steam starting gear, steam turning gear, &c. There are two large double-ended boilers constructed for a working pressure of 160 lbs. per square inch. The engine-room auxiliary machinery includes Worthington feed and ballast pumping engines, Holmes electric light engine and dynamo, Weir's surface feed-heater, Morrison's evaporater, Dunlop's patent steam and pneumatic marine engine governor. The oil-pumping machinery consists of two "Snow" duplex pumping engines 14 in. by 14 in., by 12 in. placed in a pump room amidships, these pumps are capable of a combined maximum output of 1,000 tons per hour. In the same pump-room there is placed a "Snow" pump, size 8 in. by 7 in. by 10 in., arranged to fill and empty the cofferdams and forward ballast tanks. In the boiler casing there is placed a large donkey-boiler, capable of supplying steam to all oil and water ballast pumping engines, feed-pumping donkey, electric light and cargo winches at the same time. The pumping machinery of this vessel is a special feature, everything being designed and fitted to allow of the oil being discharged and water ballast taken on board in as short a space of time as possible.

Norma.—On May 2nd there was launched by Messrs. Barclay, Curle & Co. Limited, at Whiteinch, a steel sailing four-masted barque, built to the order of Mr. M. J. Begg, of Cardiff, managing director of the Norma Ship Co., Limited. The vessel has been constructed under special survey for Lloyd's highest class. Her dimensions are:—278 ft. by 41 ft. 2 in. by 24 ft., and her gross tonnage about 2,150 tons. On moving on the ways she was named the *Norma*.

Kinross-shire.—On May 2nd Messrs. Russell & Co. launched at Greenock a steel four-masted sailing ship of the following dimensions:—Length, 283 ft.; breadth, 42 ft. 6 in.: and depth 24 ft. 8 in.; of 2,200 tons gross, and a deadweight carrying capacity of 3,700 tons. The new vessel, which has been built to the order of Messrs. Thomas Law & Co., shipowners, Glasgow, was named *Kinross-shire*, and will form an addition to their well-known "Shire" fleet of sailing ships.

Tambov.—On May 2nd, Messrs. William Denny & Bros., Dumbarton, launched the twin-screw steamer *Tambov* for the Russian Volunteer Fleet. This steamer has a gross tonnage of 4,820 tons, and is fitted with twin-screw machinery. She is intended for the passenger and emigrant service of the Russian Volunteer Fleet, and is, except in passenger accommodation, an exact repeat of the *Yaroslaval*, which the Messrs. Denny delivered lately to the same company. The launch was most successful. Madam Cevokonenko gracefully performed the ceremony of naming the steamer. After the launch the company adjourned to the luncheon-room, where the health of Her Majesty the Queen and His Majesty the Czar were enthusiastically received. Thereafter Capt. Ivanovsky, the commander of the steamer, proposed the health of the firm; and Mr. Archibald Denny proposed Madam Cevokonenko's health and prosperity to the steamer *Tambov*.

The Nelson.—On May 2nd in presence of a large number of representatives of the iron, steel, coal, and chemical industries, Messrs. J. & J. Hay launched from their yard at Kirkintilloch, a new screw-steamer for their Irish coasting trade. The new vessel was gracefully christened *The Nelson* by Miss N. Munn, Isla Villa, Mount Vernon. After the launch, the company sat down to cake and wine, under the chairmanship of Mr. John Hay, and a number of toasts were given and responded to.

Neptune.—On May 3rd Messrs. Barclay, Curle & Co., Limited, launched from their building yard, Whiteinch, a powerful steam tug, built to the order of the Glasgow and Greenock Shipping Co., Glasgow. The vessel is fitted with the most approved modern appliances for the towage of large vessels, and will have Board of Trade No. 5 Passenger Certificate, with the view of acting as tender to passenger and mail steamers when necessary. Her dimensions are:—100 ft. by 21 ft. by 11·9 ft. and measures about 140 tons. The vessel was named the *Neptune* by Miss Catherine Bennie, the Manse, Bathgate. The machinery for the vessel is also by the builders.

Sea Gull.—On May 4th there was launched by Messrs. Archibald M'Millan & Son Limited, at Dumbarton, a steel screw steamer of about 1,000 tons, which has been built to the order of Messrs. Leach & Co., London, and is intended for the continental trade. The vessel was named the *Sea Gull*. The machinery is being supplied by Messrs. David Rowan & Son, Glasgow.

Joaquim.—On May 4th the Montrose Shipbuilding and Engineering Co. launched from their yard at Montrose, the barquentine *Joaquim*, built for Messrs. Rittmeyer & Hessenmüller, Hamburg. The vessel is 139 ft. long, 26 ft. 6 in. beam, and 10 ft. deep.

Dredging Steamer.—On May 5th Messrs. Wm. Simons & Co., of Renfrew, launched a dredging steamer that has been built to order of the British Government for special work at Portsmouth. This craft is constructed of steel. The sides of the hopper are vertical instead of sloping to admit of the easier discharge of adhesive clay. The hull is divided into 6 watertight compartments. It is propelled by compound-surface condensing engines, and to have a speed of 8 knots an hour. The dredging apparatus is adapted to dredge to a depth of 40 ft. under water level. Triple barrelled steam winches are provided at the bow and stern for mooring and warping purposes. This is the fifth dredging vessel which Messrs. Simons & Co. have constructed for the British Government.

Minerva.—On May 6th Messrs. James & Geo. Thomson, Limited, launched at Clydebank the paddle steamer *Minerva*. The *Minerva* is the first of two sister ships building at the Clydebank Shipyard for the Glasgow and South Western Railway Co. Each vessel has a length of about 200 ft., and a gross tonnage of about 350 tons.

Royal Forth.—On the afternoon of May 15th the very large four-masted sailing ship *Royal Forth*, was launched by Messrs. Ramage & Ferguson, Limited, from their building yard at Leith, in the presence of a crowd of spectators. The vessel, which has been built to the order of the "Ship Royal Forth Co., Limited," 72, Bishopsgate Street, London, E.C., but which will be registered at Leith, is now the largest sailing vessel belonging to the port, her principal dimensions being:—Length, 330 ft.; breadth, 45 ft. 4 in.; depth moulded, 28 ft.; while the net register is 3,000 tons, and deadweight carrying capacity 4,750 tons. A number of very important improvements have been introduced in her construction and the strength is much over Lloyd's requirements. The crew are berthed in a spacious deck-house and in the forecastle, where their usual quarters are, a number of conveniences including bath-room have been fitted up, also lighthouses in the wings. Another house further aft provides accommodation for the apprentices, of whom eight will be carried as well as petty officers, &c. Accommodation is found aft in the poop for the captain, three officers and one or two passengers, this part of the ship being handsomely finished in polished teak and oak. A powerful donkey boiler is placed amidships and works steam winches, steam windlass for heaving up the anchors, steam capstan, also the ship's pumps and a distilling apparatus. Otherwise throughout the ship every appliance that is necessary for economical and safe

working has been provided in order to make the *Royal Forth* when completed one of the most perfect vessels of her class afloat. The naming ceremony was performed by Mrs. Cooper, wife of the captain, and afterwards the builders entertained in their model room a large company to cake and wine, of whom many were yachting-men and interested in the ship, and several members of the Leith Dock Commission were also present.

Danube.—On May 16th Messrs. James & George Thomson, Limited, launched from their shipbuilding yard, Clydebank, the *Danube*, a steel screw-steamer of about 6,000 tons, built for the Royal Mail Steam Packet Co. The vessel, which is a sister ship to the *Nile*, launched by the same firm on the 21st of March, is specially designed for the first-class mail and passenger service between Southampton, Brazil and the River Plate. Her length between perpendiculars is 420 ft.; breadth, 52 ft.; and depth, moulded, 35 ft. 5 in. She is built of steel, under special survey, to the highest class at Lloyd's, and her hull is divided into 11 compartments by 10 watertight bulkheads, which meet in every respect the requirements of the Board of Trade. She will also be available for chartering by the Admiralty in time of war. On the main, upper, and promenade decks there is accommodation for 215 first-class and 36 second-class passengers, and on the main and lower decks for 350 emigrants. The first-class saloon—a large and airy apartment with dining accommodation for 107 persons—is situated on the upper deck, forward of the machinery. It is lighted by large pivoted side-lights and by the central skylight over the music-room on the promenade deck. Abaft of the music-room is a ladies' saloon, and further aft on the same deck, but with a separate entrance, a large smoking-room; while below the dining-room on the main deck is a smaller saloon with accommodation for 69 persons. The whole of these apartments will be luxuriously fitted and upholstered. The first-class state-rooms, which extend almost from end to end of the ship on the main deck, are unusually roomy, and their fittings are of the most modern kind. The second-class saloon is on the upper deck under the poop, with the second-class staterooms on the main deck immediately below, and a smoking-room on the poop deck above. The whole of the poop deck is reserved for second-class passengers, while the promenade deck for 140 ft. amidships is set apart for the use of the first-class. This deck along its whole length is covered by a light shade deck which protects passengers from the rain or the sun, and at the same time serves to accommodate the 14 boats which the vessel carries. There will be a complete installation of electric light by the builders' own electrical staff. The appliances for handling cargo are of the most modern kind, and include six hydraulic cranes, two hydraulic derricks, two steam cargo winches, and an hydraulic winch for hoisting in the boats. The windlass and steering gear are worked by steam, and the latter is connected with the bridge by a hydraulic telemotor. Refrigerating machinery is provided with large cold air chambers and ice-making plant. The engines are of the ordinary inverted direct-acting triple-expansion type, and steam is supplied by four large double-ended steel boilers. The machinery is designed to give a high rate of speed. The launch took place shortly before one o'clock, Lady Savory, wife of Sir Joseph Savory, Bart., M.P., ex-Lord Mayor of London, performing the christening ceremony. Afterwards the builders entertained the launching party at luncheon in the model room. Mr. James R. Thomson presided, and Mr. George P. Thomson was croupier, and amongst the others present were Sir Joseph Savory, Bart., M.P., Lady Savory, Mr. W. A. Donaldson, chairman of Messrs. James and George Thomson, Limited, Mr. C. Henderson and Mrs. Henderson, Rev. Colin Nicol, Captain Buckler, and Messrs. H. Arthur, Peskitt, Welch, Jarvey, Mitchell, and Ritchie, of the Royal Mail Steam Packet Co.; Mr. C. R. Bate, Assistant-Constructor, the Admiralty; Mr. G. R. T. Cummings, R.N.; Mr. F. K. Worth, R.N.; Mr. Thom, Mr. Jamieson, and Mr. Thearle, of Lloyd's. The Chairman, in giving success to the *Danube*, hoped the two steamers would prove good money-making ships. That would be the first thing to bring the Royal Mail Co. back. Sir Joseph Savory, M.P., in replying said, that in the *Nile* and *Danube* they had two vessels on which they might pride themselves, and he believed their success was assured, consequently the company would in future have no hesitation in placing further contracts with Messrs. Thomson. The "Health of Lady Savory" was next drunk, and in proposing the health of the builders, Sir Joseph Savory remarked how much the neighbourhood was indebted to Messrs. Thomson for the wonderful zeal and activity and ability they had shown in the administration of that vast shipbuilding concern. The success which had attended their efforts was some proof of the attention and skill they had shown in the management of their vast business. They had had difficulties in the past, like every great shipbuilding firm; but they had surmounted them, and that morning had given an evidence of the successful manner in which they managed their large concern. He could not help noticing the perfect silence that prevailed during the launch. Often on similar occasions they heard shouting and other noises, which did not tend to a successful launch, but Messrs. Thomson were to be congratulated on the perfect discipline that prevailed in their yard. Mr. George P. Thomson replied. Their aim and object has always been, he said, to turn out the best work possible—work that would not only be satisfactory from the point of view of the owner, but a credit to themselves. He had to thank the officials of the Royal Mail Co. for the cordial way in which they had met the builders and assisted them in their work. In his experience of shipbuilding he never had better men to deal with. They wanted a good job, they knew a good job, and when they got it they said so. The *Danube* is expected to be ready for her steam trials in the course of about two months.

Gael.—On May 16th Messrs. Russell & Co. launched from Kingston yard, Port-Glasgow, a three-masted barque named *Gael*, of 1,510 tons register, to carry 2,720 tons cargo, to the order of Mr. D. M'Gillivray, Greenock. Dimensions:—Length, 246 ft.: breadth, 37 ft. 6 in.; depth, 22 ft. 6 in. This vessel, which was built under the superintendence of Mr. J. M'Ewan, will fit out in the James Watt Dock, and will load at Greenock, The vessel will be commanded by Captain Jones, Greenock.

Hopper Barge.—On May 17th Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley, launched a twin screw hopper barge, being the third which they have recently constructed for the Clyde trustees. Her dimensions are:—205 ft. by 35 ft. by 15 ft. 6 in.; and she has a hopper capacity of 1,200 tons. She will be fitted by the builders with two sets of triple-expansion engines, to indicate 1,200 H.P., which are expected to drive her a loaded speed of ten and a half knots. The hopper doors will be worked by improved steam friction gearing, and she will be fitted with all the most modern appliances for vessels of this kind. As she left the ways the ceremony of naming was performed by Miss Lizzie Deas, daughter of Mr. Deas, engineer-in-chief for the Clyde trustees.

Shell Drake.—On May 17th Mr. Fulton, Pittenweem, launched the *Shell Drake*, the second of the two steam fishing liners which he has built for the firm of Messrs. Spence & Co., North Shields. The length of the vessel between perpendiculars is 91 ft.; breadth, 19 ft.; and depth, 11 ft. There is commodious accommodation aft for eight of the crew, while the ice-room and the fish-room are constructed on the most improved principle. The vessel was launched into the harbour sideways, and was christened by Mrs. Lowther, wife of one of the owners.

Golondrina II.—On May 17th there was launched by Messrs. Mackie & Thomson, Govan, the *Golondrina II.*, a steel twin-screw steamer of about 600 tons, built to the order of Captain Piaggio, Buenos Ayres. The vessel, which is constructed to class 1 3-3 I.I.P. Bureau Veritas, is 200 ft. long, 28 ft. broad, and 25 ft. deep from the shade deck, 18 ft. from the awning, and 10 ft. from the main. She is intended for passenger service on the Parana, and in houses on the main and awning decks has accommodation for 90 first-class and 72 second-class passengers. Over the awning is a canvas-covered shade deck. Two sets of triple-expansion engines of 1,000 H.P. have been supplied by Messrs. Muir & Houston, Glasgow. As the vessel left the ways she was named by Mrs. Mackie, wife of the senior partner of the firm.

Sea King.—On Thursday, May 18th, there was launched from the shipyard of Messrs. Cumming & Ellis, Inverkeithing, a powerful, handsomely-modelled steel screw trawler, named the *Sea King*, built to the order of Messrs. Mackay & Co., of Leith. The *Sea King* has been built to class 100 A1 at Lloyd's special survey, but on account of the great engine power with which she has been fitted, she has been strengthened considerably in excess of the rules of this association. Among the many hundreds of steam trawlers which have been built during

the past few years, the *Sea King* holds rather a unique position, both on account of her size and power. While the average trawler measures about 100 ft. by 20 ft., with engines indicating about say 350 H.P., the *Sea King* is of the following dimensions, viz.:—112 ft. by 21 ft. by 11 ft., and is fitted with triple-expansion engines, which will indicate about 650 H.P., and which are calculated to drive her at a speed of 12 knots at sea. The engines are by Messrs. Muir & Houston, of Glasgow, who have probably constructed more trawler engines than any other firm in the kingdom, and whose experience of such engines is of the widest description. She will be able to enter the Port of Leith at all states of the tide, being fitted with water ballast in double-bottom forward, and in peak aft for trimming purposes. A fresh-water tank has also been constructed forward for auxiliary feed to the main boiler when required. By means of this powerful vessel her owners will be enabled to land their supplies of fish for the market in a much fresher condition than the ordinary trawler, and therefore reap a corresponding advantage. Externally the *Sea King* presents a very handsome appearance, having a long spring forward, with a smart-looking head and long easy lines for the high speed she is intended to obtain. She is Ketch-rigged, having a large spread of canvas. Special attention has also been paid to the trawl ports, which have been fitted in such a way as to allow the trawl hawser running square to its work at all times. A powerful steam winch of the "Humber" type, having double cylinders 7 in. by 12 in., and supplied by Messrs. Clarke, Chapman & Co., is also fitted on board for working the trawling gear; and all the other appliances about the deck are of the most modern and improved description. The accommodation for the crew is also on a more elaborate scale than obtains in ordinary trawlers. The after part of the vessel is fitted up for the accommodation of captain, officers, &c. The captain and engineer are berthed in separate staterooms, while the remainder of the after part is arranged as a saloon with two berths on either side. This saloon is handsomely fitted up in solid, polished wainscot oak, with panels of floral lincrusta tastefully tinted and picked out in suitable colours, the ceiling being painted in flat white, with tinted beam moulding. A handsome tiled fireplace is also fitted in the forepart, with ornamental and large bevel-edged mirrors. A sofa of the best crimson American leather is fitted all round the saloon, and all the other furnishings are in keeping with the parts already detailed. Access to the saloon is obtained by a commodious entrance formed by the extension of the engine and boiler casings. Forward of the engine and boiler space is the fish-hold, suitably fitted up for the storage of fish; also a large ice-hold, for the purpose of preservation when required. In the fore part of the vessel are berthed the deck hands, this place being neatly fitted up with berths, seats, lockers, &c., and also with a large stove of the most modern description. In general, the vessel has been furnished throughout in a substantial and well-finished manner, and in a superior style to the ordinary trawlers, and when she takes up her station, will be one of the largest and most powerful of her class round the shores of the United Kingdom. As the vessel glided down the ways, she was gracefully christened in the orthodox manner by Mrs. Kay, wife of one of the owners, and was immediately towed by the tug in attendance to her berth in the harbour. The company afterwards adjourned to the builder's model-room, where the various toasts usual on such occasions were given and responded to, the owners expressing themselves highly satisfied with the smart appearance and substantial and highly-finished character of the vessel in every way.

Slieve Donard.—On May 20th the paddle-steamer *Slieve Donard*, was launched by Messrs. Jas. & Geo. Thomson, Clydebank, for the Belfast and County Down Railway Co. This vessel has been designed for the company's fast service between Belfast and Bangor, and has been specially constructed to make more extended excursions along the Irish coast. Her length is 200 ft., and gross tonnage 300 tons. She is expected to attain a high rate of speed. The name *Slieve Donard*, after the highest peak of the Mourne mountains, County Down, was conferred by Miss Nina Andrews, daughter of Mr. Thomas Andrews, Belfast.

LAUNCHES—IRISH.

Ardandhu.—On May 2nd, at high water, Messrs. Workman Clark & Co., Limited, Belfast, launched from their shipbuilding yard a steel screw steamer named the *Ardandhu*, built to the order of Messrs. Clark & Service, of Glasgow, for the Ardan Steamship Co., Limited. The principal dimensions are—Length, 281 ft. 3in., breadth, 39 ft. 6 in., depth, moulded, 25 ft. 4 in.; gross tonnage about 2,150. She has been built to Lloyd's 100 A1 spar deck class under special survey. The vessel has topgallant forecastle, bridge-house and poop, the spar and main decks are of steel, and having in addition the spar deck sheathed with teak. There are four cargo holds fully equipped with steam winches, derricks, &c., and gangway doors opposite each in the bulwark. Under the bridge accommodation is provided for the captain, officers and engineers, and for the crew in the poop. The *Ardandhu* will be rigged as a two-masted schooner, and the masts have been arranged to telescope to allow of passage under bridges in Manchester Canal. The machinery had been constructed at Messrs. Workman Clark & Co.'s Engine Works, and consists of triple-expansion engines with cylinders 22 in., 36 in. and 60 diameter, stroke 42 in., steam is supplied at a high pressure from two steel boilers worked under the forced draught principle of Messrs. S. Howden & Co., Glasgow.

Xantippe.—On May 15th at high water, there was launched from the shipbuilding yard of Messrs. Workman, Clark & Co., Limited, a handsomely modelled steel barquentine built to the order of Messrs. Montgomerie & Workman, London. As the vessel left the ways she was gracefully christened *Xantippe*, by Mrs. Cruden, of Windsor. The dimensions of the vessel are:—Length, 211 ft.; breadth, 35·3 ft.; depth of hold, 17·3 ft.; gross tonnage, 960. She has been built to Lloyd's highest class and is specially designed to suit the requirements of the timber trade. A large house is fitted on deck for the crew's quarters with space at after end for the steam winch and donkey boiler. In the poop are the saloon, captain's and officers' rooms, suitably furnished and upholstered. The internal structure of the vessel has been designed with the view of loading and discharging large timber from ports placed in the bow and from the main hatch, which is specially large. The *Xantippe* will be rigged as a four-masted barquentine, the three after masts being schooner rigged, and the foremast square, giving the vessel a large sail spread. The vessel has been built under the personal superintendence of Captain Falconer.

Rhanbuoy.—On May 17th the first vessel built by the firm of Messrs. Robert Kent & Co., Carrickfergus, was launched, and was christened the *Rhanbuoy*. The vessel has been built to the order of the Rhanbuoy Steamship Co., Carrickfergus. Her dimensions are:—Length, between perpendiculars, 129 ft.; breadth, 22 ft.; depth hold, 10 ft.; and she is to be fitted with triple-expansion engines, and boiler of 160 lbs. pressure. Her registered carrying weight is about 270 tons.

Greek.—On May 18th the Union Steamship Co.'s new steel twin-screw steamer *Greek*, which has been built for service to and from South Africa, was launched from Messrs. Harland & Wolff's Yard, Queen's Island. This is the third steamer just built for the company by this firm, the first, the *Gaul*, having been launched on the 16th February, and the second, the *Goth*, on 16th March, and their construction marks a new departure in the policy of the Union Steamship Co. The *Greek* is identical in dimensions with the *Gaul* and *Goth*. Her gross tonnage will be about 4,830, and she will be propelled by manganese bronze twin screws, driven by two sets of triple-expansion engines, developing an I.H.P. of 2,000. The *Greek*, while providing a very large carrying capacity for cargo on a light draught of water, will have unusually complete passenger accommodation for first, second, and third class passengers, all of whom will be carried on the upper deck. She will be specially fitted with every convenience, including electric light, refrigerator, and cold chambers for the conveyance of fruit. Under ordinary circumstances, it is anticipated that the *Greek* will cross the bar at East London (Cape of Good Hope) and Durban (Natal), and land passengers and goods direct on to the wharves.

LAUNCH.—French.

Tréhouart.—On May 16th, at the Caudan Yard, opposite Lorient, this French ironclad, laid down in September, 1889, was launched. Originally designed as a coast-defence ship of the *Jemmapes* type, the *Tréhouart* has since been so altered in character that henceforth she must be classed as a sea-going battleship. Among the alterations the most important are the raising of the freeboard forward by 6½ ft., and to compensate for

the extra weight thus introduced, the substitution of 11·8-in. for 13·4-in. guns as the ship's main armament. Dimensions:—Length, 283 ft. 9 in.; beam, 58 ft. 5 in.; depth, 22 ft. 10 in.; extreme draught, 24 ft. 4 in. The displacement is 6,590 tons, and there will be two triple-expansion engines of 8,400 I.H.P., which are calculated to give, with forced draught, a speed of 16 knots. The armament will consist of two 11·8-in. guns, mounted single in turrets on the line of the keel, eight 3·9-in. quick-firing guns mounted in broadside, four three-pounder quick-firing, ten one-pounder quick-firing, and two torpedo-ejectors. The armour includes a complete belt, with a maximum thickness of 18 in., and a steel protective deck, with 12½ in. turrets and 14½ in. revolving cupolas or turret covers. The total cost of the ship is to be £583,300.

LAUNCH.—Shanghai.

Chin-lung.—On Saturday, March 4th, a fine new tow-boat, built by Messrs. S. C. Farnham & Co., Shanghai, for the Taku Tug and Lighter Co., was launched most successfully at Collyer's Dock. She is a single-screw tow-boat. Her length over all is 99 ft. 6 in., and 95 ft. 6 in. between perpendiculars. Her beam is 20 ft. and the depth of her hold 10 ft. 6 in. Her engines are of the compound surface-condensing type. Her cylinders are 16 in. and 32 in. by 24 in. stroke. On leaving the ways she was named *Chin-lung*.

TRIAL TRIPS.

Trefusis.—On April 22nd the steamer *Trefusis*, built by Messrs. John Readhead & Sons, South Shields, for Messrs. Ed. Hain & Son, St. Ives, was taken for her trial trip with successful results. The vessel is 290 ft. long, 40 ft. beam, and 23 ft. 2 in. deep. Motive power is supplied by a set of triple-expansion engines having cylinders 23 in., 37½ in., and 61½ in. diameter, by 39 in. stroke, by which at the trial a speed of 10¾ knots was attained.

Esparto.—The s.s. *Esparto*, belonging to the London and Edinburgh Shipping Co., which had been put into the hands of Messrs. John Cran & Co., Leith, for general repair and overhaul, and to have her engines tripled, and a new single H.P. boiler fitted to replace two of L.P., went out for trial on the Firth of Forth on Saturday, 22nd April. After adjusting compasses and cruising about for some time, she was tried for speed between Oxcar and Inchkeith Lights, and realized a mean speed of about 11 knots per hour, being 1½ knots over her previous performance. The I.H.P. was about 200 more than before, with 25 per cent. less boiler power. The arrangement, proposed by Mr. Young, superintending engineer of the London and Edinburgh Shipping Co., has created some local interest—the three new cylinders being put in the same space previously occupied by two. The cylinders 17 in., 28½ in., and 46 in. diameters by 39 in. stroke, with the H.P. No. 1 in the middle having its cranks in the old L.P. eccentric pit; the I.P. No. 2 where the former H.P. was; and the L.P. aft as before. The H.P. cylinder has a piston slide valve behind it, actuated by eccentrics on the forward end of crank shaft, working a rocking shaft by lever, with reversing link motion at the outer end and lever with crosshead under the piston valve. The I.P. cylinder is fitted with the usual D slide valve, and the L.P. with Thorn's improved trick valve for economizing steam. The air and circulating pumps and gear were not interfered with. For convenience of starting a small H.P. engine is fitted on the forward column, with all-round motion for starting and reversing engines. This engine shaft is fitted with sprocket wheel and patent chain link band for turning engines, and can be worked either by winch or main boiler. The ease and rapidity with which the engines were started and reversed was very noticeable. The cross coal bunker in the ship is now dispensed with, and the side bunkers carried well into the engine-room take its place. The engine-room fitted with new duplex donkey of a size suitable for ballast tank pipes is roomy and convenient, and there is easy access to all working parts. The arrangement has been carried out in a substantial, neat, and skilful manner by Messrs. John Cran & Co., all the valves and gear being worked in the simplest and most direct manner, and placed in handy positions. There was ample supply of steam on the trial, which was of a very successful character, and to the evident satisfaction of the director and officials of the company and friends who were present.

Comet.—On April 22nd the p.s. *Comet*, which embodies some unusual features of design, went on an experimental cruise. The craft, which was launched in the autumn of last year by Mr. R. Rodger, boatbuilder, Port-Glasgow, is of the following dimensions:—Length, about 90 ft.; breadth, 10 ft.; depth, 5 ft. She is built after the design of a modern river steamer, having a saloon fore and aft, the latter being handsomely upholstered, and, for the size of the vessel, commodious. She has been built expressly to experiment with and demonstrate Mr. M'Intyre's patent geared engines. The machinery has been supplied by Messrs. Hannah, Donald & Wilson, Paisley, and is of 60 I.H.P. The engines are triple-expansion of the most approved type, with cylinders of 5½ in., 8½ in., and 14 in. diameter by 9 in. stroke. The crankshaft is geared to paddle wheels about 8 ft. in diameter, the engines going four revolutions for one of the paddle wheels. The advantages claimed by Mr. M'Intyre, the patentee, are that the first cost is cheaper, and the deadweight of the machinery carried is about that of direct-acting engines, making it possible for shallow-draught steamers to be fitted with the most modern type of machinery. It may be added that this new geared machinery is being fitted on a steamer being built by Messrs. John Reid & Co., at Whiteinch. This steamer is of about 150 ft. keel, and is for the Goole and Hull passenger service.

S. W. R. No. 1.—On April 26th Sir Raylton Dixon & Co. sent out for trial trip the screw steam Hopper barge *S. W. R. No.* 1, which they have built for the London and South Western Railway Co. This vessel has been specially designed for the particular conditions under which she will require to work in connection with the important dock improvements, &c., which the company are carrying out at Southampton, and a full outfit of improved appliances has been fitted for efficient working under all circumstances. The results of the trial gave a speed of 10 knots, and the greatest satisfaction, as the construction of such vessels is a speciality of her builders. The principal dimensions are:—Length, 152 ft. 6 in.; beam, 25 ft. 1 in.; depth, 10 ft., with a hopper capacity of about 500 tons of dredged materials. The construction of the vessel has been under the department of Mr. John Dixon, Dock Superintendent, Southampton, and been superintended by Mr. Clark. She has been built and delivered in the short space of three months. The engines have been fitted by Messrs. Westgarth, English & Co., of Middlesbrough. After the trial the steamer proceeded to Southampton.

Phœnix.—On Wednesday, April 26th, the steel screw steamer *Phœnix* left the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesbrough, for the purpose of going through a series of speed tests, which were most satisfactory. This vessel has been built to the order of Messrs. Hoyland & Co., of London, under the superintendence of Mr. Robert Eeles, of Newcastle-on-Tyne. She is of the partial awning deck type, and will take Lloyd's highest class. The principal dimensions are:—Length, 311 ft.; beam, 40 ft.; depth, moulded, 22 ft., 11½ in., with a deadweight carrying capacity of about 4,000 tons. A full equipment is fitted of the most efficient machinery for the rapid loading and discharging of all descriptions of cargoes. Engines have been fitted by Messrs. Thos. Richardson & Sons, of Hartlepool, the cylinders being 24 in., 38 in., and 64 in., by 42 in. stroke; with two large boilers working at a pressure of 160 lbs. At the termination of the trials the steamer proceeded to Blyth, where she will load her first cargo.

James Brand.—On April 29th the new tank steamer *James Brand*, built by Messrs. Sir W. G. Armstrong, Mitchell & Co., for Mr. Alfred Suart, of London, was taken to sea for trial trip. The vessel has been constructed on Swan's system, and her principal dimensions are:—Length, 352 ft.; beam, 44 ft.; and depth, moulded, 31 ft. She is built to the highest classification at Lloyd's, and is capable of carrying about 5,000 tons of oil, besides bunkers on a moderate draught of water. Her propelling machinery has been manufactured by the Wallsend Slipway and Engineering Co., and has cylinders 25 in., 41 in., 67 in., by 48 in. stroke, which on trial gave every satisfaction, a mean speed of over 11 knots being obtained. For dealing with the cargo, the vessel has two large Worthington pumps, and Mason's skylights have been fitted in the engine-room.

Gulnare.—On April 29th the s.s. *Gulnare*, built by Messrs.

Charles Connell & Co., Whiteinch, and engined by Messrs. Dunsmuir & Jackson, Govan, went her official trial trip, when she attained a speed of 10½ knots, loaded. She has been specially designed and constructed for employment in the Admiralty Survey on the Canadian coast, to the plans of Staff-Commander Tooker, R.N., who has charge of the survey. Her dimensions are as follows:—137 ft. 6 in. by 20 ft. 6 in. by 14 ft. 4 in.; and her engines, which are triple-expansion, have cylinders 13 in., 20 in., and 33 in., by 24 in. stroke. The trial trip was in every respect highly satisfactory.

Princess May.—On April 29th the saloon paddle steamer *Princess May*, built and engined by Messrs. Barclay, Curle & Co., Limited, for the Brighton, Worthing, and South Coast Steamboat Co., Limited, went down the Clyde to run her official speed trial between the Cloch and Cumbrae Lights. Her dimensions are:—Length, 160 ft.; breadth, 21 ft. 6 in.; depth, 8 ft. 9 in.; and gross tonnage, 250 tons. She is fitted with compound surface-condensing diagonal engines, having cylinders 22 in., and 42 in. diameter by 42 in. stroke. The trial was satisfactory in every respect.

Spondilus.—This ship which has been built by Mr. James Laing, of Sunderland, engined by Messrs. Geo. Clark, Limited, Sunderland, went to sea on the 1st of May on her maiden voyage. Her leading dimensions are:—Length 347 ft.; breadth, 45 ft. 6 in.; depth, 28 ft. 6 in.; with engines which have cylinders 26 in., 42½ in., and 69 in., by 45 in. stroke, taking steam from three single-ended boilers of large capacity. She is the third of three sister ships built by the same firm to the order of Messrs. M. Samuel & Co., of 31, Houndsditch, London, under the superintendence of Messrs. Flannery, Baggallay, & Johnson, of London and Liverpool, and is designed to carry petroleum in bulk or general cargo, and has special facilities for speedily purifying the oil tanks, and quickly making them ready for general cargo; the ceiling has been specially adapted. She is built to the highest class at Lloyd's under the three deck rule, and fulfils all the Suez Canal requirements, and is constructed with 12 tanks, and a special tank to enable her to load down to her summer freeboard, the tanks having a capacity for 5,000 tons of oil. In addition to a powerful and complete pumping and ventilating arrangement the vessel is provided with all the latest improvements, including a very complete installation of electric light throughout the ship, a projector and all accessories for navigating the Suez Canal at night, steam steering gear amidships and hand gear aft, steam windlass, stockless anchors, and six powerful steam winches for the rapid handling of general cargo, duplex pumps fitted in pump-room amidships, capable of discharging the entire oil cargo in 12 hours. On an exhaustive full speed trial of several hours, when everything worked in a thoroughly satisfactory manner, she attained a speed of 10 knots, with about 5,360 tons deadweight on board, and the vessel was taken over by the owners, and proceeded on her voyage to Batoum to load a cargo for the East *via* the Suez Canal.

Holmside.—On May 4th the steamer *Holmside*, which has been built by Messrs. Wood, Skinner & Co., of Bill Quay-on-Tyne, to the order of Messrs. William Swanston & Sons, Newcastle, went for her official loaded trial trip off the mouth of the Tyne. The trial was in every way successful, giving entire satisfaction to all concerned, as, although a strong easterly wind was blowing, a speed of over 10¼ knots was obtained. The propelling machinery, which consists of a set of triple-expansion engines, having cylinders 17 in., 28 in., and 46 in., by 30 in. stroke, worked throughout in the most efficient manner. The vessel combines all the essentials of a modern cargo steamer, carrying a large deadweight on a very light draught, and with an exceedingly small coal consumption. Her principal dimensions are:—Length between perpendiculars, 206 ft.; breadth, extreme, 30 ft.; depth, moulded, 16 ft.; and a carrying capacity of about 1,300 tons. The ship and engines have been built under the superintendence of Messrs. W. Menzies & Co., Newcastle.

Cumberland.—On May 4th the screw steamer *Cumberland*, of 400 tons, built by Messrs. John Fullerton & Co., Paisley, for Messrs. J. J. Mack & Sons, Liverpool, was taken for her trial trip, with successful results. Motive power is supplied by a set of compound engines constructed by Messrs. Ross & Duncan, Govan, by means of which, at the trial, a speed of 10¾ knots was attained.

H.M.S. Endymion.—On May 5th the first-class protected cruiser, H.M.S. *Endymion*, 7,350 tons displacement, and 12 guns, which has been built, engined, and completed by Earle's Shipbuilding and Engineering Co., Limited, Hull, was taken on her official trial trip, when a continuous run at full speed for eight hours was made in the English Channel, with the result that the engines indicated 10,646 H.P. at 99·4 revolutions, with an air pressure equal to only 0·17 in. of water. The speed shown by log was 21 knots, which is greatly in excess of what was anticipated, and the consumption of coal was also most satisfactory, being 1·6 lbs. per I.H.P. per hour. There was not a hitch throughout the whole of the day, and the machinery worked smoothly and regularly, causing much gratification to all concerned. The *Endymion* goes at once into Portsmouth harbour to be brought forward and prepared for her commission.

London Belle.—On May 12th the p.s. *London Belle*, just completed by Messrs. William Denny & Bros., Dumbarton, for the London, Woolwich, and Clacton-on-Sea Steamboat Co., went on her official trial, which consisted of four consecutive runs between the Cloch and Cumbrae Lighthouses. The weather was very unfavourable for such a trial, but the result was eminently satisfactory both to builders and owners, the speed being considerably above that contracted for. After the trial the vessel left for London to begin her service on the Thames.

Gundreda.—On May 12th the new steel steam yacht *Gundreda*, 385 tons Y.M., left Leith Roads for the Colne, having gone through her speed trials on the Firth of Forth previously. This very fine yacht has been built by Messrs. Ramage & Ferguson, Limited, to the order of H. J. Barrett, Esq., of Langford Park, Maldon, Essex, to replace the *Malikah*, also a Leith built vessel, sold by him last year to Prince Henri de Bourbon. Her principal dimensions are;—Length, B.P., 164 ft.; breadth, 22 ft.; depth moulded, 14 ft. 5 in.; while the engines are triple-expansion with cylinders, 15 in., 24 in. and 39 in. diameter, by 2 in. stroke, with a large steel boiler working up to 160 lbs. pressure. On the official trial the first run was one of four hours' continuous steaming, which was carried out without a hitch, the average speed being nearly 13 knots with the engines indicating considerably over what was stipulated by contract. A series of graduated speed trials was afterwards run over the measured mile at Gullane, which were even more satisfactory, as the maximum showed about 13·4 knots with the engines working at 124 revolutions, while 12½ knots were easily attained on what might be termed easy steaming. All the other appurtenances of the yacht, including the electric lighting, were thoroughly tested, and an examination of the sumptuously fitted up cabins below by those on board showed that they were finished to the same high standard of excellence which characterized the rest of the vessel. The *Gundreda* which has two masts and a raking cutwater, has been designed by Mr. J. E. Wilkins, of Wivenhoe, and is expected to make her first appearance down south at the Nore to Dover match of the Royal Thames Yacht Club, of which Mr. Barrett is a member.

The Midnight Sun.—On Saturday, May 13th, *The Midnight Sun*, which has been specially prepared for cruises among the Norwegian fjords, was taken on her official trial trip from the Tyne. The importance of the occasion justified the issue of a large number of invitations in order that a thoroughly representative gathering might have an opportunity of seeing how the latest floating palace would behave herself in the water. The promise of a beautiful day doubtless augmented the attendance, and when the steam tender left the New Quay at North Shields, about ten o'clock in the morning, there was well nigh three hundred ladies and gentlemen crowding the deck of the little tug. A few minutes' run brought the tender to the outer end of the piers, where *The Midnight Sun* was lying. In the clear light which prevailed the noble proportions of the vessel were brought out to the greatest advantage, and every one at once expressed themselves as delighted with the exterior of the ship, as they were soon afterwards to be by her interior arrangements and fittings. A few minutes later the vessel was under way, and ploughing the sea in the direction of Whitley for the speed tests over the measured mile. Here she ran up and down the coast for two or three hours. The sea was in capital condition for a fair test. The water was as smooth as it could well be, and there was little more than a breath of wind blowing from a point of the compass not far removed from due south. The ultimate result was the attainment of the capital speed of seventeen miles per hour, which will be amply sufficient to meet the most exacting demands of modern

travellers who have a deeply-rooted dislike to slow ocean travelling, and will make the voyage from the Tyne to the Norwegian fjords a very brief spin indeed. *The Midnight Sun* is a vessel of 3,250 tons, and is propelled by engines having a H.P. of 2,860, her splendid speed enabling her to do the journey from Tynemouth to Utsire, the first sighted bit of the Scandinavian peninsula, in 22 hours. She is not a new vessel, but has been completely overhauled and altered by Sir W. G. Armstrong, Mitchell & Co., to fit her for the purposes of a first-class yacht. She has accommodation for about 250 passengers, and for luxurious appointments and convenience, even to the smallest details, she is not to be surpassed. Special attention has been bestowed upon the sleeping berths, which are large and well-ventilated. The beds are placed opposite each other, instead of one near the floor and the other some feet above it. This is a valuable improvement upon the old order of things. Under the olden-time arrangement it was a comparatively easy matter for the trained gymnast who happened to have the upper bed, to vault into his nightly couch, but to the elderly or obese tourist it was always an undertaking associated with considerable difficulty, and indeed danger, especially if the sea was not in an amiable mood. There are also bath-rooms, lavatories, and every other convenience in profusion. The dining saloon is a vast and beautiful apartment, extending the whole width of the ship, being 80 ft. in length, and having seating accommodation for about 180 people. Above this is a music, drawing, and reading room, 90 ft. in length, and furnished in every variety of luxury which the upholsterer's art can suggest. There is, too, a very large smoke room on deck, and a pretty little retiring room is situated aft above the companion stairs. There are a number of specially-appointed conveniences which cannot fail to be appreciated by tourists. One of these is a dark room where the amateur photographer may develop at his leisure the sun pictures of the magnificent scenery of the fjords which he may obtain during the tour. There is also a barber's shop, with Figaro in attendance, where locks may be shorn and stubbly chins made smooth. Tourists need not burden themselves with a vast aggregation of linen, for a laundry is provided, in which washing and ironing will be done "while you wait." The ship also possesses its own newspaper, known by the happy title of *The Daily Rays of the Midnight Sun*. A medical officer and a real Norwegian pilot are also to be numbered among the luxuries, or perhaps we should rather say conveniences of the vessel. Ocean travelling certainly cannot be made more comfortable than on *The Midnight Sun*—not, at all events, until that desirable consummation when the waves shall have been conquered. Until some genius earns the undying gratitude of the human race by putting an end to sea sickness the best that can be done is to be ill amid pleasant surroundings; and even "mal de mer" should be, comparatively speaking, endurable in this magnificent floating hotel. The officers and crew of the vessel belong to the Royal Naval Reserve. The commander is Lieut. Richard Nivison, R.N.R.; the chief officer is Lieut. J. Dundas Ross; second officer, Lieut. H. W. Bennett; and third officer, Lieut. Chapman Haigh. She also carries a purser and five engineers. The steamer is owned by the Albion Steamship Co., her managing directors are Messrs. Pirrie, Hope & Co., while the booking agents are Messrs. C. Jurgenson & Son, Newcastle. Mr. C. Jurgenson's great knowledge of Norway will be of great service to the company, and his name is a sufficient indication that everything worth seeing in Norway in a fortnight's cruise will be included in the itinerary.

Gaul—On May 13th this steamship, the latest addition to the Union Steamship Co.'s fleet, went for a trial trip in the Solent. The vessel was built by Messrs. Harland & Wolff, of Belfast. Dimensions:—Length, 400 ft.; breadth, 47 ft.; and depth, 31 ft.; gross tonnage, 4,700. Her engines have developed an indicated power of 2,200 horses, and on the run round from Belfast to Southampton the average speed was twelve knots.

Alexandra.—On May 13th the p.s. *Alexandra*, of Swansea, went down the river for trial, after having been in the hands of the London and Glasgow, England and Iron Shipbuilding Co. Limited, for the past three months. During this period she has been converted from the old simple engines with jet condenser to compound engines with surface condenser. The alterations were carried out under the supervision and to the specifications of G. S. Goodwin, Esq., of Liverpool, and are of the most complete character. The two old cylinders, 52 in. diameter, 57 in. stroke, have been replaced by two new cylinders, 32 in. and 52 in. diameter respectively. One of the air pumps has been discarded and also the old jet condenser and a new steel surface condenser erected thereon. The circulating pump is centrifugal made by Drysdale & Co., and the feed pump is one of Weirs' well-known type with automatic control gear. The new boilers are 14 ft. in diameter by 9 ft. in length, having three furnaces in each 3 ft. 6 in. diameter; working pressure, 85 lbs. All the alterations were made in accordance with Board of Trade and Lloyd's requirements. The results of the trial were very satisfactory, the speed obtained being considerably in excess of her previous performance, and the former consumption of coal was reduced to less than half. After trial the vessel left for Swansea under the charge of Captain Smith, where she arrived early on Monday morning after a very successful run. Many alterations were also made in the arrangement of the saloons, engine, and boiler castings, &c., with the result that the passenger accommodation is much increased, the tonnage considerably reduced, and the vessel so modernised that it was hardly possible to recognise in the steamer on trial on Saturday May 13th, the vessel that appeared on the Clyde in February.

Aras.—On May 15th the *Aras*, a steel screw steamer, built by the Palmer's Shipbuilding Co., of Jarrow and Howdon, to the order of Messrs. Bessler, Waechter & Co., London, proceeded on her trial trip. The vessel, which is rigged as a two-masted schooner, is of the following dimensions:—Length, moulded, 325 ft.; breadth, moulded, 42 ft. 6 in.; depth, moulded, 29 ft. 9 in.; gross tonnage, 4,700. She is constructed to take the highest class in Lloyd's spar-deck type. The *Aras* is specially constructed to carry petroleum oil in bulk, the machinery, &c., being placed aft, and separated from the cargo tanks by an extra strong bulkhead. The oil is contained in 14 large tanks and all the latest pumping machinery is supplied for the discharging of the cargo. The trial resulted very satisfactorily.

Falken.—On Saturday, May 20th, the s.s. *Falken*, built by Messrs. Craig, Taylor, & Co., of Thornaby-on-Tees, to the order of Consul Apel Georgü, Esq., for the Rederiaktiebolaget "Condor," of Stockholm, under the superintendence of Jean Drakenberg, Esq., and Captain Alex Von Bjornmarck, was taken to sea for her trial trip, which proved highly satisfactory, a speed of 9¼ knots (loaded) being obtained. The vessel is of the following dimensions:—244 ft. by 34 ft. by 17 ft. 9 in. depth moulded, and has triple-expansion engines, built by the North Eastern Marine Engineering Co., Sunderland, 18½ in., 30 in., 49 in., by 33 in. stroke, two steel boilers, 160 lbs. pressure. After the trial trip the vessel immediately proceeded on her voyage to Stockholm, under the charge of Captain Von Bjornmarck.

Bezwada.—On May 23rd the British India Steam Navigation Co.'s new steamer *Bezwada*, built by Messrs. Alex. Stephen & Sons, Linthouse, ran her official trial trip in the Firth. The British India Co. was represented by Captain Hodgkinson, Mr. Clark, Mr. Martin, and Mr. Barr, and the builders by Messrs. A. E. and F. J. Stephen. The machinery worked perfectly without trace of heating. A speed exceeding expectation was obtained, and everything was regarded by the owners' representative as being highly satisfactory. The *Bezwada* is of noble proportions with an extremely good appearance in the water for a cargo steamer. She carries no less than 7,200 tons deadweight, being the largest cargo steamer yet built on the Clyde. Her dimensions are:—Length, 400 ft. between perpendiculars; breadth, extreme, 48 ft.; depth, moulded, 31½ ft. The engines have cylinders 26 in., 41 in., and 67 in. diameter, by 48 in. stroke, with a working pressure of 160 lbs. The vessel is of spar deck type, with poop, bridge, and topgallant forecastle, and 100 A1 class in Lloyd's, and is fitted with everything necessary for dealing easily, rapidly, and economically with large cargoes of every description. She is to sail under charge of Captain Avern, one of the most experienced commanders in the British India Co.'s service. The *Bezwada* is the third steamer added by Messrs. Stephen to the British India fleet.

The Atlantic Ferry.—Taking advantage of the interest recently aroused by the rapid passage of the *Campania* from New York to Queenstown, an interest likely to be maintained during the Chicago World's Fair season, Messrs. Whittaker & Co. will issue immediately an illustrated popular edition of Mr. Maginnis's book, entitled "The Atlantic Ferry," the first and complete edition of which was recently so well noticed by the press. Besides being well illustrated the edition will give all the latest records and events of Transatlantic steamships, and will be published at half-a-crown.

Reviews.

Elementary Engineering; a Manual for Young Marine Engineers and Apprentices, in the form of Questions and Answers. By J. Sherren Brewer, Government Marine Surveyor at Hong Kong. Second edition. London: Crosby Lockwood & Co. 1893.

THE author of this little book has unfortunately died since the publication of the first edition, and the present issue has been prepared by another hand. Corrections have been made, and a supplementary chapter added. The form of question and answer is one that we always feel very doubtful about. Its advantage, of course, is that it aids the student in committing its contents to memory. But it is possible for one to commit to memory without thoroughly understanding what one learns, and the constant break in the continuity of the idea by the insertion of the questions seems to deaden the mental faculties of the reader. Yet a silent admission of the impossibility of the system is found in the fact that chapters xv. and xvi., on boilers, by the original author, and chapter xxi., the additional chapter by the present editor, are written in the ordinary narrative form. The aim of the book—to give engineering students an opportunity of learning something regarding the early processes through which their materials have passed before they come to their hands—is an excellent one, and it has been well carried out. The book cannot fail to be useful, and we heartily recommend it to the young engineer. But when the present edition is exhausted and a new one called for, may we advise the editor to run his matter nto chapters of the ordinary kind, and put his questions on the subject of each chapter together at the end? When he is doing that he might also put his account of a reverbatory furnace into his chapter on iron, where it is first referred to, instead of keeping it for that on copper. We have looked very carefully through this little work, and find nothing else which we would have remedied. The directions and explanations given on the subject of the working and management of machinery are all clearly and forcibly put, and are the advice of a very practical man who knows the requirements and difficulties of the youngsters.

Fifty Years Hence. By Robert Grimshaw. New York: The Practical Publishing Co. 1893.

IT is but a few weeks ago that we noticed the present author's book, "Tips to Inventors," and commented on his vigorous and characteristic style and his great knowledge of the present wants of the community. That work was really on all-fours with that we are about to notice. To the mind which can suggest possible inventions and improvements, it must be easy to imagine a state of things in which these inventions and improvements are carried out. Then is the task rendered less difficult by the fact that he who prophesies is not desired or expected to tell HOW the wonders of fifty years hence are to be obtained. We are to have them, that is enough.

No doubt a vast number of the advantages Mr. Grimshaw gives are as certain to come—perhaps not within the period he fixes, but at all events within a reasonable time—as anything can be in this world. Such things as telegraphic communications with railway trains, the universal introduction of heating, electric lighting, and power from central stations, are possible to-day. The only hindrance is the question of expense. That is certain to be rapidly reduced, and in any case he would be a severe critic indeed who forced an author to the fence in an imaginative flight on a question of £ s. d.

The subject of cremation is one to which the prophet may safely refer, and tell of its universal introduction. It is but a decade ago that the celebrated judgment of Mr. Justice Stephen, in the case of the Welsh bard who died last year, decided that it was not contrary to the law of England to dispose of the dead human body by cleansing fires. In the brief time that has elapsed since that decision, cremation has made very rapid progress, and with cholera now threatening us and symotic diseases rife in our midst, not only enthusiasts who hate the idea of putrefaction, but the sensible man who cares little as to what becomes of his remains, are beginning to feel that a duty is laid upon them to lead the unthinking multitude by their example to a better way of the disposal of the dead than by the unsanitary and extravagant interment which has not even the recommendation of antiquity, at least not amongst the more civilised portions of mankind. The reviewer was perusing to-day an old life of George Stephenson, written for boys, and was greatly struck in it by the fact (which is not newly discovered) that that great man's disciples had to restrain him from saying too much about his hobby. He believed that a locomotive could do twelve miles an hour. He was not allowed to say that it could do more than four. In those days people generally were of a really Conservative turn of mind and honestly feared the new and unknown. The wonders of steam in various branches of industry has changed all that, and no one need fear that the incredulity of the public will ruin his invention. The fear is rather the other way. Thus it is that at the end of the nineteenth century new inventions—intrinsically good—are much more quickly accepted than they were at the beginning, and there is no inherent improbability in the proposition that fifty years hence many inventions not yet known to us may be in universal use. The writer sincerely hopes that 1943 will see the marine engineer flourishing like a green bay-tree, and he does not therefore by rash prophesy desire to injure the reputation of those who in future years may wield his pen; but we believe that in marine matters our author is weak, as he is in the same subjects in his other book. He says that electrically propelled argosies make the passage from Montauk Point to Bristol in three days; we venture to think that the day of Montauk Point's glory and of the return of Bristol's is more than half a century off. Whilst we further believe that until such great natural forces as the flow of rivers or the movement of the tides can be utilized electricity as a motive power for ship propulsion is out of the question. But we must not take the book too seriously. It is well thought out and very interesting, and it is gilded with a fine halo of romance in the surroundings of the student Brathwaite. It is well worth the notice of our readers, for it is suggestive, and may lead our readers to think out the clue to some of the problems of which the Q.E.F. alone is indicated in the book before us

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The Journal of the Iron and Steel Institute. No. II. of 1892. London: E. & F. N. Spon.

THIS volume contains the history of the Autumn Session, held at Liverpool, under the presidency of Sir Frederick Abel, in September, 1892. The President's address was a brief, but interesting *resumé* of the progress of science during the period which had elapsed since he last addressed the Society. He referred to the successful experiments undertaken by Professor Dewar in liquefying oxygen. These have already received considerable public attention. A lecture, with a demonstration, has been twice given before the Royal Institutes, and on one occasion the Prince of Wales expressed the public sense of the magnitude of his discovery. To what this may eventually lead in the practical arts we cannot, of course, tell. But it seems certain that he has shown first that a true vacuum is an absolute non-conductor of heat, and secondly, that there is a new and valuable method of determining the purity of metal, which, in point of accuracy, far surpasses anything yet known to us. Both these points may, hereafter, be of value in the manufactory as well as in the laboratory. As Sir Frederick Abel well points out, the fact that the expense of producing the first small quantities in the laboratory is alarming, has not in previous instances proved that subsequent discoveries may not render a substance's production commercially possible. Sir Lowthian Bell's paper on the manufacture of iron in its relation to agriculture is well worthy of careful study. Like everything from his pen it is highly suggestive, and gives the reader much interesting matter to consider and ruminate upon. He refers to the great waste which used formerly to go on in the production of coke and gas, and in the manufacture of iron. The revolution produced in many arts by the discovering of the fact that throwing the residual products of gas-making away was the destruction of a very valuable source of manufacture is well known to our readers. Now, the great Scotch ironmasters have adopted a plan, fully described in this paper, for recovering the sulphate of ammonia, which previously went to waste from their blast furnaces. What economy this plan effects may be shown from the statement that in three weeks the Carnbroe Chemical Co. consumed 5.841 tons of coal, and from this has extracted—

		£	s.	d.
Sulphate of Ammonia, 48 tons 8 cwt., sold at	£10 10s.	508	4	0
Pitch ... ... 361 " 0 " "	21s.	379	1	0
Oil ... ... 33,750 galls. "	$1\frac{1}{2}$d.	210	18	9
		£1,098	3	9
Less paid, wages, sulphuric acid, management, railway dues, and allowance for depreciation of plant		379	12	3
		£718	11	6

leaving a balance profit and interest on plant equal to 2s. $5\frac{1}{2}$d. per ton of coal. The discovering of this process has cheapened the products, and thus saved the consumer £250 on the qualities above quoted, and thus beside circulating the money spent in wages and carriage has put a thousand pounds worth of wealth, which would otherwise have been lost to the world, out of that five thousand tons of coal. Truly, modern science achieves many things, beside which the transmutation of metals, the dream of generations of alchemists, is surpassed. His aim, if he realized it, might have enriched himself. The feats of the modern men of science enrich at once both himself and the world at large! Proceeding, the author refers to phosphorus, which, when present in his iron ore, is the bugbear of the ironmaster. It is, however, indispensable to animal life, and the agriculturist to-day has to scour the earth to obtain it as manure for his fields. As Sir Lowthian points out, there is a vast loss to the country incurred by permitting 20,000 tons of phosphorus to poison 2,000,000 tons of pig-iron annually, when it is wanted by the farmer, and he thinks that the introduction of the basic process tends to remove this economic blot from the manufacturing escutcheon of the nation.

We have lingered too long over this fascinating subject, and our review of the remaining papers must, unfortunately, be a very briefone. Mr. J. H. Greathead contributes an account of the Liverpool Overhead Electrical Railway, which will interest many of our readers who have seen and used this structure, the first of its kind in Europe, though, of course, the steam-driven railway is known to every one who has ever visited New York. But of local matters the most interesting to marine engineers will probably be Professor Hele-Shaw's account of the Walker Engineering Laboratory, given by the munificence of one of them, who made his fortune in Liverpool. Other Liverpool men have contributed handsomely to this institution, amongst others, Mr. Henry Tate, who has not forgotten London in his generosity. Surely, a professor of the institution benefited might have given him credit for his good deeds. As it is, a Tait gets the credit in this paper.

Mr. R. A. Hatfield describes the alloys of iron and chromium at considerable length, and includes in his exhaustive survey of the subject, a report by Mr. F. Osmond. So far chrome iron is chiefly known as a material for the production of armour-breaking projectiles, but its uses seem likely to be more extended, even including, according to a smart American advertisement, quoted by the author, the manufacture of bars for gaols, which will be warranted to disprove the poet's assertion, that "Stone walls do not a prison make, nor iron bars a cage."

Aide Memoire de l'Officier de Marine. 1893. Par Edouard Durassier et C. Valentino. Paris: Libraire Militaire de L. Badouin. THE sixth issue of this year book is now before us. The features which we referred to still characterize it, whilst there have been useful additions made. Of these the most interesting and important is the table of the comparative strength of the navies of the world. In making such a table the editors had several courses open to them. They might have put down every vessel owned by the powers, whether of modern or antiquated type, whether ready for service or merely in process of construction. The course they determined to adopt is a sensible one. They have left out the older vessels, with the result that there are excluded—

German.—1 armour-clad of upwards 8,000 tons; 5 armour-clads of less than 8,000 tons; 11 armoured gunboats of less than 12 knots speed.

English.—4 armour-clads of 10,000 tons, and less that 16 knots speed; 13 armour-clads of 8,000 to 10,000 tons, and less than 14 knots speed; 1 armour-clad of less than 8,000 tons and 14 knots speed; 11 coast defence vessels of less than 6,000 tons, and of less than 14 knots speed; 2 armoured gunboats; 3 cruisers of under 16 knots speed 7 cruisers of under 14 knots speed.

American.—1 armoured cruiser of 11 knots; 4 monitors of $10\frac{1}{2}$ knots; 13 monitors of 6 knots.

French.—5 armour-clads of 8,000 to 10,000 tons, and 14 knots speed; 2 armour-clads of less than 8,000 tons, and 14 knots speed; 8 cruisers of less than 2,000 tons, and 14 knots speed.

Russian.—1 armoured cruiser of less than 18 knots speed; 4 armoured cruisers of less than 12 knots speed; 22 coast defence vessels of less than 10 knots speed; 2 cruisers of less than 4,000 tons, and 16 knots speed; 8 cruisers of under 14 knots speed 6 torpedo boats of 40 to 100 tons, and under 18 knots speed.

Having thus explained the basis upon which the authors work, we may now proceed to give an extract from the table. The navies of the world are tabulated. We only take some of the most important, and we do not separate the Australian from the British Navy, as is done in the book.

	Germany.	England including Australia.	America.	France.	Italy.	Russia.
Armour-clads of 10,000 tons and upwards and at least 16 knots	1	13	...	5	8	3
Do. of 10,000 and upwards and under 16 knots	...	2	...	2	2	...
Do. of 8,000 to 10,000 tons and 14 to 16 knots	...	...	...	...	...	...
Do. of less than 8,000 tons and over 14 knots	1	1	...	4	...	1
Protected Cruisers of 6,000 tons and 18 knots	...	...	2	1	...	2
Do. of 4,000 to 6,000 tons and 18 knots	...	7	...	...	...	...
Coast Defence Vessels of 8,000 tons and 16 knots and upwards ...	...	2	...	...	...	...
Do. of 6,000 to 8,000 tons and 14 knots	4	2	...	5	...	...
Do. of less than 6,000 tons and of 14 knots	3	1	2	2	...	...
Armoured Gun Boats of 12 knots and upwards	...	...	...	8	...	1
Cruisers, Despatch Boats, and Gun Boats of 8,000 tons and 18 knots and upwards	...	2	...	...	...	1
Do. of 4,000 to 8,000 tons and 18 knots and upwards	3	7	4	5	...	2
Do. of 4,000 to 8,000 tons and 16 to 18 knots	...	3	1	3	...	...
Do. of 4,000 to 8,000 tons and 14 to 16 knots	...	4	...	...	...	...
Do. of 2,000 to 4,000 tons and 18 knots and upwards	1	38	3	1	7	1
Do. of 2,000 to 4,000 tons and 16 to 18 knots	1	1	1	...	5	1
Do. of under 2,000 tons and over 14 knots	7	18	5	8	8	10
Torpedo Gun Boats of 20 knots and upwards	1	...	...	...	7	3
Do. of 18 to 20 knots	...	...	...	1	4	2
Do. of 16 to 18 knots	...	10	...	4	...	...
Torpedo Catchers of 20 knots and upwards	9	10	...	...	6	...
Do. of 18 to 20 knots	2	10	...	10	...	...
Do. of 16 to 18 knots	3	1	...	...	1	...
Torpedo Boats of 120 tons and upwards and 22 knots and upwards	4	1	...	1	...	5
Do. of 120 tons and upwards and 20 to 22 knots...	...	1	...	5	...	1
Do. of 100 to 120 tons and 20 knots	10	...	1	15	2	2
Do. of 40 to 100 tons and 20 knots	78	45	1	109	73	22
Do. of 40 to 100 tons and less than 20 knots	...	22	...	...	...	12
Do. of less than 40 tons and less than 18 knots	...	30	...	41	42	2

This table, if it does nothing else, serves to show our terrible deficiency in torpedo boats—a want which we referred to in our notice of this book last year. The 10 first-class torpedo boats provided in the present estimates will do no more than keep our present insufficient stock, for with such little craft, subject to such excessive strain as these are liable to, a life of ten years is all that can be expected, and with a fleet of 100 a yearly addition of 10 vessels merely keep us up to date, and cannot be pretended to increase our resources.

In the list of armed cruisers one or two corrections should have been made. The *City of Chicago's* bones have lain nearly twelve months on the rocks of the Irish Coast, the *Paris* and the *New York* are transferred to the American flag, and we imagine that the *Berlin* is no longer on the list now that her fellows are gone. We may add that since the volume was printed the *Celtic* has been sold to foreigners, whilst the addition of the *Campania* and *Lucania* takes away the *Umbria* and *Etruria*. The armed cruiser idea has been adopted, not only by the United States, but also by Continental navies. Yet we do not find these vessels included in the lists of other countries, and then it must be remembered that in this respect their strength is understated.

The whole volume, with its notes on the personnel and material of the various navies, its tables relating to various types of guns, cannot fail to be of value to our readers, and we are pleased to recognise that as each succeeding issue is published the work becomes more widely known and more appreciated, not only in France but also in our own country.

The Naval Annual. 1893. Edited by T. A. Brassey, B.A., F.R.G.S. Portsmouth: J. Griffin & Co. 1893.

This important chronicle of the progress of the navies of the world makes its appearance somewhat earlier than is usual. The plan followed is similar to that of previous issues, with the addition of the new detailed tables of torpedo boats by Mr. Laird Clowes, which we shall refer to later.

In his annual review Lord Brassey concludes that all powers have, during 1892, found the wisdom of abandoning the monstrous guns, whose conduct in previous years had caused grave doubts to be entertained as to their reliability. Another abandonment has been that of forced draught, which he says was adopted hastily and without due consideration of the conditions of naval battles. At the most critical period in the life of our warships, it would be impossible to induce the stokers to remain below with every egress closed. Forced draught, however, has not been condemned, we take it, so much on that ground—true and sufficient though it be—as on account of the ill effect it has upon the boilers and furnaces to which it is applied. The introduction of the triple screw is noted with regret, as being another complication added to the already sufficiently involved machinery department. Meanwhile, experiments are being made with good results in the direction of submarine navigation, which the author does not hesitate to call an accomplished fact. No doubt the introduction of submarine boats which can attack the unarmoured bottoms of battleships in their most vital parts will necessitate important alterations in our methods of building. Torpedo nettings will be useless against a foe which can dive under and come up inside such protection. But there is one point here which must not be forgotten. Lord Brassey has already referred to it in his remarks on forced draughts. We mean the personal element. If it be hard to keep the stoker battened down in battleships in action when he is in his accustomed place doing his accustomed work, it will surely be doubly hard to get the submarine boat's crew into action when the success of their operations is likely to involve their own destruction, and they are meanwhile working under what are and must be, till submarine navigation is universal, strange, and unnatural conditions. In concluding this general review Lord Brassey remarks on the fact that increased cost and advance in science are making those navies, which cannot maintain and even increase their expenditure, fall back and lose their importance. The consensus of opinion puts the limit of a battleship's speed at 18 knots. But very fast and very large cruisers are being built. This he considers a judicious policy. We are very pleased to obtain this expression of opinion from him. Considering that he has always been a determined advocate of a restriction in the size of battleships the admission is doubly valuable. We ourselves have been impressed with the wisdom of the Admiralty in deciding to build the two 500 ft. cruisers as an answer to the *Rurik* and the American *Columbia*. But Admiral Colomb, whose membership of the House of Commons perhaps gives some weight to his utterances, has, in the pages of the *Times*, assailed the Admiralty, and said that the action is mistaken. The fourteen hundred thousand pounds to be spent on these two vessels had better be spent on four inferior in size, speed, armament, and healthy qualities. He sings the praises of inferior ships. Indeed his own arguments are the best answer to his proposition, and we only noticed him to show that the recognised independent naval authority is dead against him.

Turning to the individual navies it is to be noted that the French naval estimates exceed those of any year since 1870, and amount to over ten million sterling. In the new battleships the British practice of mounting the guns in pairs in enclosed turrets is at last adopted—a very satisfactory proof of the wisdom of our plan. But there are points in which French practice differs from ours, and is in fact superior. We refer to the high bows, which we have discarded, and they retain. As regards the arrangement of the armour belts, it is doubtful which practice is the better. Both are and must be compromises. However, another advantage possessed by our modern navy is incidentally seen from the note on the *Magenta*, which began her trials in the present year. She has been ten years building, and in course of construction has had to be altered to make her suitable for carrying a quick-firing battery. Such deviation may be necessary, but the result is unsatisfactory when the original design is tampered with, and a ship more of the year 1883 than of 1893 must be produced. The *Royal Sovereign* class, built right off the reel, maintain the continuity of the design far better than can any of these ships delayed in construction to await the result of experiment and experience. The fact should not be missed that whilst 27 knots for torpedo boats is our present aim, M. Normand is building a 30 knot vessel for our neighbour. Germany too is building four boats of this class—even exceeding 26 knots having been actually tried. She too has produced the cruiser *Kaiserin Augusta*, which represented her at the New York Naval Review—a vessel whose performances will be watched with interest, seeing that she has triple-screws and is said to be as fast as the British cruiser *Blake*. Germany, however, like Italy, is obliged to restrict her naval expenditure at present. The latter has abandoned the construction of monster ironclads and is building the *Admiral Saint Bon*, of 9,800 tons displacement, protected by 9¾-in. armour and armed with 25 c.c. guns. Four cruisers of 6,500 tons and 14,000 H.P., are also to be constructed. Russia, on the other hand, is increasing her expenditure, and has laid down three battleships at St. Petersburg. They are to be of 11,000 tons displacement, with nearly 16 in. of armour and a primary battery of four 12-in. guns mounted in pairs. Two coast-defence ironclads and a cruiser, beside which even the *Rurik* is to look small, show her determination to keep her position on the sea. Holland is also alive to the importance of the navy, and has determined on a programme comprising four ram cruisers besides gun vessels and torpedo boats; whilst Turkey and Spain are bestirring themselves.

In the United States the new navy, which dates from 1881, is progressing rapidly. The progress is, however, delayed by the difficulty of procuring armour-plates for the battleships. Nickel steel has the approval of the authorities for guns as well as for armour. For the Argentine Republic two little ironclads of 2,300 tons displacement with two 24 c.c. guns and 8-in. of armour and nearly 14 knots speed, and a cruiser, the *Nueve de Julio*, also of 22⅝ knots, have been built in England. Whilst Chili has got her *Capitan Prat*, of 6,901 tons and 18 knots speed, also armed with 24 c.c. guns. This vessel was built in France and an improved *Nueve de Julio* also has been ordered by them from Armstrong's. If these South American Republicans have their faults they certainly find occupation for the European shipbuilders and designers, and from time to time give the world data to go upon.

Summing up, Lord Brassey thinks that in view of the French and Russian programmes we ought to spend four and a-half millions a year on new constructions, and that our deficiency is chiefly in torpedo boats and armoured cruisers. This is a point that has been mentioned frequently before and it doubtless will be again, before the want is supplied. Sir Geoffrey Hornby—a new contributor, gives an interesting note on the training of officers. He believes that admirals should be elected by special fitness, not promoted to command by mere seniority. On the

question of manning it is insisted that more should be made of the Royal Naval Reserve, and the French system is thoroughly gone into to show what can be done in that direction. In Mr. Oldknow's remarks the boiler difficulty has attention, and the various improvements possible by the adoption of the Thorneycroft boiler as in the *Danish Geiser* already successfully tried, and in H.M.S. *Speedy*, now preparing for trial, or by that of tubulous boilers on the plans of *Yarrow*, *Belleville*, or *du Temple*. There is no doubt that there is more room for improvement, and therefore for increased efficiency from a given weight in the boiler than in any other part of a ship and her machinery, and the point cannot have too much prominence. His note on page 114 regarding broken shafts in the Mercantile Marine, allows the editor to make the first misprint we have ever seen in these volumes, *Noordland* being wrongly rendered. The position of the engineering branch of the navy, as regards pay and responsibility, when compared with those of other non-combatant branches is forcibly noticed, not more strongly than the anomaly of the case warrants. The usual tables of ships and guns, and details of naval estimates, appear in their proper place.

The new feature of the book in Mr. Laird Clowes' tables of torpedo boats, compiled by himself from the latest attainable information, and corrected by the various builders. The total aggregates 1,329. Of these we have only 206, including those owned by the Colonies, whilst France has 229, Russia 166, Germany 153, and Italy 132. Then there is a great gap, Austria being sixth with 63. This makes our position as regards this force bad enough, but when the vessels are subdivided according to size, we appear even worse. Taking only vessels over 101 ft. long—and Mr. Clowes rightly holds that those under this limit are not of much value for sea service—it appears that France, Germany and Italy are all before us. It is true that, including boats now building, if those under 150 ft. long were excluded, we should stand first. The notes to these tables are very interesting, and are perhaps the most valuable part of the book, treating as they do of a subject which to our mind needs instant attention on the part of the Admiralty.

Space does not permit us to treat of the other and not less important parts of the book, but it will be apparent that the seventh issue of the annual is not less instructive and important than its predecessors.

Correspondence.

[It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—ED. M. E.]

BREAKDOWNS.

To the Editor of THE MARINE ENGINEER.

SIR,—In your issue of May 1st, under the heading of Breakdowns and over the initials "J. L. N. Y.," appears an account of the successful repair of the steamer *Ægean's* crank shaft by her chief engineer at sea. Permit me to testify to the truth of the statement, and to supplement it. The fracture was at the after end of the after crank-pin (ordinary compound engines), and consequently the repair had to bear the whole strain of the engine power. The vessel did not wait for the strength of the monsoon to decrease, but proceeded on her voyage as soon as ready.

This repair of a complete fracture was effected with the ordinary tools of an ordinary tramp. By comparison I think this feat far in advance of the *Umbria's* repair, it simply prevented the extension of a flaw, a bad flaw certainly, in the straight part of the shafting of that vessel—as a matter of course the appliances in the one case were much better than in the other. The *Ægean* reached London in safety, her repaired shaft was landed for a short voyage and then put on board again for a spare one, and remained there for that purpose until the vessel was wrecked by collision.

I think the chief engineer's name was Mackay. All honour to him and men of his stamp, and there are many of them. They do immense service to steam shipping, in a modest way.

I assisted in managing the steamer at the time this accident happened, and I can certify that the work done, as it was, saved her owners and underwriters many hundreds of pounds.

I am, Sir,
Yours faithfully,
ALBERT S. FROUD, Lt.R.N.R.

London, May 6th, 1893.

THE RACE BETWEEN THE "PARIS" AND "TEUTONIC."

To the Editor of THE MARINE ENGINEER.

DEAR SIR,—Being a reader of the above paper, I feel somewhat disappointed in not finding in either the April or May numbers an account of the race between the *Paris* and the *Teutonic*. I shall feel extremely obliged if you could tell me the name of the winner, and also their respective times of arrival off Sandy Hook, or wherever the race terminated. Trusting I am not giving you too much trouble, and thanking you in anticipation,

I remain, yours respectfully
JNO. B. HARTNESS (an interested one).

(We give our correspondent the information he desires:—)

	City of Paris.	*Teutonic.*
Passed Daunts Rock, 23rd. Feb.	2.30 p.m.	1.17. p.m.
Sandy Hook Lightship beam 1st Mar.	12.34. p.m.	1.58. p.m.
Official time of Passage.	d. h. m. 6 2 39	d. h. m. 6 5 41
Runs 1st day.	469	493
" 2nd "	502½	489
" 3rd "	414½	408
" 4th "	495	479
" 5th "	471	450
" 6th "	512	541
	2,862	2860

[In justice to the British vessel we may point out that she had been in port but six days, whereas the *Paris* had been thoroughly overhauled previous to starting, not having been out during the winter. As we foreshadowed in our previous note on the subject, the *Germanic* and *Britannic* made the passage in nearly 24 hours less than the *Berlin* and the *Chester*, while the result of the so-called race between the *Majestic* and *New York* appeared in our March issue.—ED. M.E.]

PURITY OF WATER IN MARINE BOILERS.

To the Editor of THE MARINE ENGINEER.

Sir,—In your issue of February 1st, you gave a précis of a paper on "The necessity of, and Means for, Maintaining the Purity of Water in Marine Boilers," read by Mr. J. B. Edmiston, at a meeting on the 9th of January, of the Hull and District Institution of Engineers and Naval Architects. I am sorry your space did not permit of a full reprint of the paper, which I think should be one of great interest to marine engineers. I have written to you in the hope that you will be able to furnish me with the name of the makers of the filter referred to in the paper, or perhaps publish a description of it. If you can assist me in any way by an answer in your next issue I shall feel greatly obliged.

FILTER,

Hong Kong, March 29th, 1893.

[The makers of the filters are the Glasgow Patents Co., Limited, Wellington Works, Glasgow. We gave a description with illustrations in our April number. —ED. M.E.]

Steam Tug.—There was recently launched from the yard of Messrs. John H. Dialogue & Son, at Camden, N.H., U.S.A., a steam tug, built for Mr. J. E. Du Bignon, Brunswick, Ga. The vessel is 110 ft. long, 21 ft. beam, and 11 ft. 5 in. deep.

S.S. "Curry."—On April 27th there was launched from the yard of Messrs F. W. Wheeler & Co., West Bay City, Mich., U.S.A., the screw steamer *s.s. Curry*, built for the Hawgood and Avery Transit Co., Cleveland, O. The vessel is 378 ft. 6 in. long, 45 ft. 3 in. beam, and 26 ft. deep. Motive power will be supplied by a set of triple-expansion engines having cylinders 23 in., 37½ in., and 63 in. diameter by 44 in. stroke.

The annual general meeting of the Hull and District Institute of Engineers and Naval Architects was held at the Institute Rooms, Bond Street, on Monday, May 8th, when the following gentlemen were re-elected as officers for the ensuing session:—President, Mr. John Spear; Vice-President, Mr. F. H. Pearson; Members of Council, Messrs. J. R. Smith, M. Stirling, W. Harris and R. Pawley; Hon. Treasurer, Mr. A. N. Somerscales; Auditors, Messrs. J. Innes and J. Brackenbury; Hon. Sec., Mr. Geo. H. Strong, care of J. Jamieson & Co., consulting engineers, Hull. We understand that an invitation has been received from the Leeds Forge Co., Limited, for the members of this Institute to visit their works during the summer (in conjunction with the members of the North-East Coast Institution of Engineers, who have also been invited), when it is anticipated a most enjoyable day will be spent.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from April 17th, 1893, to May 19th, 1893.

7785 H. F. Hiron. Anchors.
7801 J. Howell and E. A. Ashcroft. Generating steam.
7827 J. Appleby. Adjusting the pressure of shafts.
7843 J. A. Barker. Wrenches.
7844 W. P. Thompson. (C. F. Holt and W. S. Starr, United States.) Speed indicator.
7849 W. Heslop. Pressing boats from sheet metal.
7871 J. Atkinson. Motors.
7890 A. E. Hubert and W. Edwards. Indicator for steam nozzles.
7896 J. Kenney and C. Forrest. Construction of ships.
7948 W. H. Witte. Propulsion of vessels.
7959 A. T. Elford. Propellers.
8075 G. Chapman. Screw propellers.
8114 J. E. Taylor. Preventing corrosion of shafts.
8134 R. S. Brownlow. Heating feed-water.
8153 C. J. Guthrie. Detaching gear for ships' boats.
8158 J. T. Lindahl. Valves for petroleum motors.
8226 G. Pinder. Ships' rockets, signal lights, &c.
8231 A. D. Hall and G. B. Sloan. Screw propeller.
8250 P. Jensen. (C. T. Geissler, Germany.) Aerial ships.
8295 W. E. Syer. Apparatus for raising sunken ships.
8316 New and Mayne. Electric propulsion of boats.
8317 A. Miller. Heating feed or supply-water.
8389 M. L. Sykes. Metal for bearings of shafts.
8411 W. P. Thompson. (C. T. E. Clausen, Denmark.) Ships' compasses.
8457 H. B. Beeney. Twin float, &c., cycle boat.
8468 J. Linkleter. Life rafts.
8485 H. T. Grainger and J. P. Clark. Vessel propulsion.
8509 W. von Schirach. Ships.
8562 J. Y. Johnson. (N. Dymocff, Turkey.) Ships or vessels.
8591 L. C. Gueit. Screw propellers.
8605 R. Roper. Stowing boats upon ships.
8607 R. Roper. Ships' davits.
8609 R. Roper. Ships and rafts.
8611 R. Roper. Boat disengaging gear.
8719 C. W. Matthews. Anchor.
8748 C. H. Bickley. Oar, scull, and paddle blades.
8760 A. C. Embling. Sail hank.
8781 C. W. Dawson. Shafts for marine engines.
8790 W. P. Thompson. (G. Völlner and F. Lehmann, Germany.) Ascertaining the capacity of hollow vessels.
8798 E. Capitaine. Petroleum motor.
8840 P. Garton. Bracket for vessels.
8844 J. Douglas. Heating and ventilating ships.
8876 A. Swanson. Improved propelling of boats.
8951 R. Bomford and B. Bomford. Dredgers.
8986 J. B. Noble. Anchors.
9041 S. Drzewiecki. Ejecting of launching torpedoes.
9121 G. Taylor. Apparatus for loading vessels.
9156 H. S. Holgate. Pedal-propelled boats.
9186 T. R. Oswald. Construction of ships or vessels.
9232 E. Fletcher. Improved ships' telegraphs.
9256 L. Gathmann. Guns for firing torpedoes, &c.
9272 T. Armstrong. Propelling apparatus for ships.
9275. R. H. Kjellevold. Construction of boats.

BOARD OF TRADE EXAMINATIONS.

EXTRA FIRST CLASS.

April 29th, 1893.

Nicol, Andrew .. .. Ex 1C Leith.

May 13th, 1893.

Coomber, Wm. G. .. Ex 1C London.

NOTE.—1C, denotes First Class; 2C, Second Class.

April 29th, 1893.

Buist, Wm. ..	2C	Liverpool
Ferguson, J. K.	2C	Aberdeen
Findlay, Wm ..	1C	"
Guvan, John J.	1C	"
McLean, Allan	2C	Liverpool
Morgan, R. F...	2C	N.Shields
Neil, James ..	2C	"
Nicol, George A.	2C	Aberdeen
Pink, Wm. J. ..	2C	S'hmpt'n
Reynolds, Thos.	2C	Liverpool
Senington, S. A.	2C	S'hmpt'n
Skentelbery, C.	1C	N.Shields
Spence, A. J. ..	1C	Aberdeen
Thompson, E. R.	1C	N.Shields
Vincent, G. W.	2C	London
Young, Jas. M.	2C	Liverpool

May 6th, 1893.

Abraham, T. A.	2C	Cardiff
Cannell, John..	1C	Liverpool
Cargill, John F.	2C	Leith
Clements, C. S.	1C	London
Douglas, John	1C	Glasgow
Fairfoul, David	2C	"
Fairgreive, Geo.	1C	Liverp.
Farbridge, J. W.	1C	Leith
Farrow, R. W.	1C	London
Filshill, John..	1C	Glasgow
Fletcher, L. ..	1C	N.Shields
Flintoff, T. W.	2C	"
Fulton, Wm. G.	1C	Leith
Gay, Alexander	1C	"
Gerrey, Alex. ..	2C	Glasgow
Harlow, A. J. ..	1C	Cardiff
Hill, James....	1C	Greenock
Jarvis, William	1C	Cardiff
Lesse, L. W. L.	2C	N.Shields
Logan, Malcolm	2C	Greenock
Mackey, John C.	2C	N.Shields
MacMair, J. B.	1C	Glasgow
Mann, Peter F.	1C	"
McAlister, A. M.	1C	"
McCartney, J...	1C	"
McGregor, Alex.	1C	London
McKinnell, W. P.	1C	Leith
McLauchlan, J.	1C	Liverpool
Meldrum, Jas..	2C	Glasgow
Miller, Hy. R..	1C	London
Niven, Robert..	2C	Greenock
Owens, Owen ..	1C	Liverpool
Parker, Thos. S.	1C	Cardiff
Perivancich, L. J.	2C	Greenock
Purvis, James..	2C	London
Reid, Thomas..	2C	Leith
Richards, Henry	1C	Liverpool
Richardson, G.	1C	Greenock
Robertson, J. H.	2C	Glasgow
Sharp, R......	1C	Cardiff
Shrigley, T. W.	2C	N.Shields
Smith, John ..	1C	Glasgow
Somerville, T. T.	1C	"
Studdart, Robt.	1C	Liverpool
Symons, T. H.	2C	Cardiff
Thomas, F. R.	2C	"
Watson, Andrew	1C	Liverpool
White, William	2C	Glasgow
Wigton, John F.	2C	"
Wiles, Alfred J.	1C	London

May 13th, 1893.

Barry, Wm.....	2C	Dublin
Baty, Geo. R. ..	1C	N.Shields
Campbell, H. A.	2C	Liverpool
Campbell, Robt.	2C	London
Christian, Chas.	1C	Liverpool
Davidson, Alex.	1C	Cardiff
Duffus, Wm. ..	2C	Dundee
Edwards, A. G.	2C	London
Evans, Edward	1C	Liverpool
Gambles, John	1C	"
Hamilton, Fred.	2C	Dublin
Hobkirk, C. H.	2C	N.Shields
Keay, Robt. D.	2C	Liverpool
Lambert, Jno..	2C	N.Shields
Lewis, Richard	1C	Liverpool
Lloyd, Morgan	2C	Cardiff
M'Onegal, Jno..	2C	London
Parsons, S. J..	2C	Liverpool
Scott, W......	1C	N.Shields
Setford, Harry	1C	Liverpool
Sharp, H. F....	2C	N.Shields
Stephenson, J. J.	2C	"
Stewart, Wm..	2C	London
Stones, E. L..	2C	"
Swanson, J. M.	1C	N.Shields
Thomas, Hugh	1C	Liverpool
Watkins, Wm.	1C	Cardiff
White, Arthur G.	2C	London
Williams, J. F.	2C	Cardiff

May 20th, 1893.

Aitken, Henry	2C	London
Alexander, D. A.	2C	Aberdeen
Bewick, J. T. ..	2C	N.Shields
Blann, Hy. Jas.	2C	Aberdeen
Bodger, C. P. ..	1C	W.Hrtlpl
Boyd, Gilbert..	2C	London
Bryce, Robert..	2C	Glasgow
Cockburn, Chas.	1C	W.Hrtlpl
Curry, James ..	2C	N.Shields
Downie, John..	1C	Aberdeen
Evans, Wm. ..	1C	Liverpool
Evitt, Thomas	1C	Glasgow
Forbes, John ..	2C	"
Fortune, Wm...	1C	London
Gibson, G. A. ..	2C	N.Shields
Hamilton, D. ..	1C	"
Hill, Sydney J.	2C	London
Hood, William	1C	W.Hrtlpl
Johnston, Alex.	1C	London
Johnston, Wm.	2C	Glasgow
Kendall, Henry	1C	London
Logan, K. G. M.	2C	Glasgow
Macdonald, G.	2C	"
Mackenzie, R. M.	2C	London
Pain, Austin T.	2C	Dover
Pallister, G. H.	2C	N.Shields
Robertson, G. R.	1C	Aberdeen
Rowlands, J. H.	1C	Liverpool
Selby, Charles	1C	Glasgow
Suggitt, W. A..	2C	W.Hrtpl
Sutherland, J.	2C	Liverpool
Tiplady, Wm...	1C	N.Shields
Todd, W. K. ..	1C	W.Hrtpl
Urquhart, F. ..	1C	Aberdeen
Whitfield, Wm.	2C	N.Shields
Wilks, C. E. ..	1C	W.Hrtpl
Wilson, F. Wm.	2C	London
Young, John ..	1C	"

The Marine Engineer.

LONDON, JULY 1, 1893.

WHATEVER may be asserted in favour of the imperial, travelling, and commercial advantages of the Canadian Pacific Railway Co., it must be self-evident to well-informed persons that anything approaching the full development of these results can only be attained by the regular running at short intervals of fast steamers between England and Canada, and that colony and Australia, in connection with rapid express trains between Halifax or Quebec and Vancouver. The Canadian Parliament have voted a subsidy of £100,000 per annum for a term of years, for establishing a new line of very fast steamers between England and the Dominion; but as no tender has been accepted for such a service after advertisements had appeared for it, that Legislature was, according to the opinion of the High Commissioner of Canada, prepared to support such local government in increasing the amount of the subsidy by a further £50,000 a year for this splendid object. No contract appears to have been made for the purpose. We are glad, however, to learn that a strong inducement has been given for such an agreement to be made in consequence of the contract entered into with the New Zealand and Australasian Steamship Co., of Melbourne and Sydney, formed last year, whereby they have arranged to run a monthly service of fast steamers between Vancouver and Sydney, calling at the Sandwich Islands and Brisbane, in consideration of a subsidy of £25,000 per annum from the Dominion Government for five years. Mr. James Huddart, of the firm of Messrs. Huddart, Parker & Co., a long established Australian shipping firm with headquarters at Sydney, has been the prime mover of this new route from Great Britain to Australasia. It has been very favourably commented upon by the *Times*, *Montreal Gazette*, *Toronto Empire*, *Sydney Morning Herald*, *Melbourne Argus* and other leading newspapers in Great Britain, Canada, and Australaia. The steamers agreed to be run between Sydney and Vancouver, are the sister ships *Miowera* and *Warrimoo*, which have been trading between Australia and New Zealand. Each steamer is 357 ft. long by 42 ft. 3 in. beam, with a moulded depth of 28 ft., and a registered tonnage of about 3,400 or nearly 5,000 tons cubic capacity. They were built last year by Messrs. Swan & Hunter, of Newcastle-upon-Tyne, and engined by the Wallsend Slipway Co., and both have given every satisfaction. They have attained the speed of 17 knots on their trial trips. It is proposed to propel them between Australia and Canada at about 14 knots, which after allowing for a short detention at Honolulu, would convey mails and passengers from Sydney to Vancouver in 21 days. They could, however, in emergency cases be driven about 15½ or 16 knots between the Dominion and Australasia. If the steamers run in 21 days from Vancouver to Sydney or *vice versa*, they would make shorter time by several days than the existing service between San Francisco and Sydney *viâ* Honolulu and Auckland by the liners of the Oceanic Steamship Co., and the Union Steamship Co. of New Zealand. The *Miowera* and *Warrimoo* are fitted with the most improved triple-expansion engines, refrigerators for ships' use, duplicate electric lighting and special ventilation for tropical voyages. They have been built upon the three deck grade with a long poop extending over the engine-room, a top-gallant forecastle, and a complete water ballast arrangement on the double bottom system. The saloons are very spacious and most beautifully decorated and furnished. They are 50 ft. long, and occupy the entire width of the ship, and are capable of accommodating 100 passengers. The state-rooms are also large and well furnished, and fitted with every convenience. There are a sufficient number of excellent marble baths, situate at convenient positions of each steamer. The smoking rooms on the forward deck are of the most elegant description, and are remarkably comfortable. They contain panels of polished veined marble, ornamented with very artistic designs between pilasters of marble, and are surmounted with crimson and carmine frieze, with gilded lines. In short, they are as comfortable as first-class Atlantic liners. These two steamers will offer a route to Australia which will be of inestimable value in the event of war, which might cause the Suez route to be unavailable for the ships of the British Navy or the Mercantile Marine, because by the new route, troops and military and naval armaments and stores, mails, and passengers, and several articles of merchandise, would not touch foreign territory. Again, there are many passengers to the Antipodes who can scarcely tolerate the heat of the Red Sea, or make a long voyage without breaking it by a short stay on land. It is therefore properly stated in the *Times* that "it cannot be doubted that to exchange such heat and the monotony of a prolonged sea voyage across Canada with all its magnificent scenery, and the opportunity to break one's journey at any point one pleases, will be eagerly embraced by a large number of travellers, and the prospects of the new venture as regards passengers at the least seem already to be well assured, even though at present there is no suggestion of competing with other routes in the matter of a saving of time." It is reasonably thought by the Canadians and Australians that the running of the two steamers just mentioned will greatly increase the trade between the Dominion and our Australian colonies. At present

the imports to Canada from Australia have been so small in value as not to be deemed worthy of a special classification in the Dominion trade returns, while the Canadian exports to Australasia have not materially exceeded in value the imports referred to. It is expected that there will be large imports in Australia of agricultural implements, machinery, and soft timber from Canada, and that Australia will soon export much larger quantities of wool to Canada, and also will send them large supplies of fruit and much larger of meat. Mr. D. E. Brown is making a tour of enquiry on behalf of the Canadian Pacific Railway Co., through the Australian colonies, and has been commissioned by that company to establish agencies at Auckland, Melbourne, Sydney, Adelaide, and Brisbane, in connection with the export and import of cargoes between such colonies and Canada. He recently stated to a representative of the *Melbourne Argus* that British Columbia for the last six years has raised no sheep, "and not within 50 per cent. of the beef required for its own consumption. The mutton consumed is almost exclusively brought in from the States of Washington and Oregon. The consumer has to pay 8d. or 9d. per lb. for mutton decidedly inferior to yours. There is no reason why Australian and New Zealand mutton, which I understand can be produced here for 1½d. a pound in large quantities, could not be laid down there with freight, insurance and all other charges paid at about 4d. per pound, and used to the total exclusion of the inferior article from the United States." Plans have been submitted to the Admiralty of the two new steamers of the New Zealand and Australian Steamship Co., with the view of having them placed on the list of that Government Department as available during hostilities as armed cruisers, and thus become eligible for the Imperial subvention. It is thought that they will soon be placed on the list, as it is essential to have on the Pacific a larger number than at present of swift steamers of the British Mercantile Marine which can be quickly utilised as auxiliaries to the ships of our Navy in a maritime war. It is hoped that to supplement the subsidy granted by the Canadian Government for running the *Miowera* and *Warrimoo* between Sydney and Vancouver, the various Australian Governments would between them give another £20,000, the amount asked from them, and which would be reduced by the amount of postages. It is, however, questionable whether such an amount will be granted in the present defective condition of Australian finances. It is a cause of congratulation, however, to the owners of these liners, that the Government of New South Wales has so well recognized the importance of the new steamship route between Sydney and Vancouver, that it has decided to give £10,000 towards the necessary additional subsidy, and it is probable that the further £10,000 required from the other Australian colonies will soon be ordered to be granted. On the 18th of May the *Miowera*, the pioneer steamer of the new service, sailed from Sydney for Vancouver. It has been recently stated on good authority that it is very probable that a new line of very fast steamers will be run from Milford or some other British port and Quebec and Halifax. If so, no time will be lost in putting on faster steamers than the *Miowera* and *Warrimoo* between British Columbia and Sydney, so that it is probable that the run from England to Brisbane in about three or four years hence may be accomplished in about 24 days. In this event there can be no doubt that not only can mails and passengers, troops and military, and naval armaments and stores be carried between Great Britain and Australia in a shorter time than by any existing route, but there will be at least half a dozen additional first-class merchant steamers qualified to become very efficient improvised armed cruisers during war. The new service in the Pacific will create a closer bond of friendly feeling between Canada and Australia, much to the benefit of both, and will also add to the strength and stability of Imperial Federation.

As an interesting corollary to our precis of the Report of the Admiralty Committee upon Boilers and Engines in the Navy, we are glad to be able to draw our readers' attention to some most valuable results of carefully conducted trials, as to the actual performances in regard to coal consumption of ships of war as collated by W. H. Riley, Esq., R.N., Staff Engineer and communicated by him to the Royal United Service Institution. Mr. Riley very properly points out the difficulty of obtaining good average results from ships of war owing to the very irregular character of their cruises, and owing also to the considerable proportion of power employed for auxiliary engines, and distillation of fresh water, but in spite of these disadvantages Mr. Riley appears by great care in the experiments and tests carried out, to have arrived at a large number of results that contain very valuable information as to actual facts. He gives an example of carefully tested actual consumption of fuel in a large modern battleship, on ordinary peace service for six months, in which the figures are as follows:—Steaming, making good distance, 869 tons; laying and banking fires, no distance logged, 335 tons; culinary and warming purposes, 112 tons; distilling, 481 tons; electric lighting, 554 tons; other auxiliary purposes, 211 tons. It will be seen from these figures that a warship on an ordinary six months' cruise uses nearly as much fuel for the modern installation of electric lighting as it does

for direct steaming, and that the fuel consumed for the whole of the auxiliary purposes together is nearly twice that used for direct steaming. This is a startling result surely. Of course in war time, where any runs were required at full speed, the consumption for direct steaming would be greatly increased, whilst probably the auxiliary demands would remain about the same. The datum from a large battleship as to the percentage of coal used per I.H.P. is in our opinion very favourable to the design of the engines for moderate speed, and to some extent controverts the statement of the Reporting Committee, mentioned in our last issue, that the engines of the Navy do not as a rule run economically at low speeds. Possibly the care that has been taken by Mr. Riley to eliminate fuel used for auxiliary purposes from that used in direct steaming, explains the difference in Mr. Riley's statement of results as compared with the fears of the want of economy at slow speeds. If the whole fuel consumption is taken together, it is evident that the auxiliary wants become a much heavier proportion at slow speeds than at high speeds, and will make the consumption per I.H.P. of the main engines much greater at slow speeds. The data Mr. Riley gives as ascertained facts are that at a percentage of full designed power of 55, the consumption in main engines is 2·03 lbs. of coal per I.H.P.; at 28 per cent., 1·82 lbs.; at 22 per cent., 1·93 lbs.; at 14 per cent., 1·76 lbs.; and at 7 per cent., 2·2 lbs. From these figures it appears that the consumption of coal per I.H.P. is actually least when indicating only 14 per cent. of the full power. We should imagine as the consumption is the highest at 55 per cent. of the full power, with the exception of the case when the power is only 7 per cent. of full power, that the engines in this case are especially designed to give best ratio of expansion at small powers, and that when pressed to full power, the consumption will be less favourable than those shown above. We are not sure that this is not good policy, for as matters now go, a ship-of-war lives most of its life on a peace basis where slow speeds are sufficient, and where the daily economy is of most value to the tax-payers. Provided the engines are capable of exerting their full power satisfactorily on emergency, it may be better that they should have to do so at an extra cost of fuel consumption during such emergency, so that they should be economical under normal circumstances at slow speed. We are afraid it is hopeless to expect a set of engines to be equally economical at full power, and at a power of only 12 per cent. or 14 per cent. of full power. Another point of great importance ably defined by Mr. Riley, is the comparison of the actual distance in knots travelled by a battle-ship per ton of coal consumed, thus giving a basis for a deduction as to the most "economical speed." The figures given from test are as follows. At a speed of 13·66 knots the vessel runs only 2·08 knots per ton of coal; at 10·9 knots speed it does 3·7 knots per ton; at 9·92 knots speed it does 4·0 knots per ton; at 8.96 knots speed it does 6·2 knots per ton; at 6·77 knots speed it does 7·5 knots per ton. This result of course ensues from the much higher rate at which the power increases in comparison with the increase of speed. It appears that a limit of economy for distance travelled per ton of coal is reached eventually at very low speeds, though it is not indicated in the above figures. At this point, which is rarely higher than 12 per cent. of the full forced draught I.H.P., the most "economical speed" is reached, which may be of importance when the question arises as to the greatest distance to be reached for a given quantity of coal on board. But it must also be remembered that as auxiliary uses of fuel do not much decrease with the speed, the lowest speeds will show large consumption on auxiliary purposes owing to the long time occupied on the course. There is no doubt that the most economical results with low powers is to keep up the steam when first admitted to full boiler power, and to increase the ratio of expansion as the power is diminished, without throttling the steam. If this point be not regarded even a triple expansion engine may be worked less economically than a bi-compound engine. This statement is substantiated as a fact from an instance quoted by Mr. Riley. In the *Blake* and *Blenheim* the engines are duplicated in two separate sets to each propeller shaft, so that, at moderate speed only, either the forward or after engines need be used. From experience it would appear that this arrangement has resulted in a substantial reduction of the coal expenditure when running at 9·6 knots. The subdivision of boilers would be useful also in the same sense where an average low demand of power could be depended upon. But as in warships it is usually necessary, that reserves of steam and boilers must be ready at short notice, this arrangement cannot be taken advantage of to its full extent. Good economy may, however, be effected by a temporary reduction of the grate area, either by allowing the back bars to become clinkered over, or covering part with fire-brick, or by cutting off access of air to part of the fire bars by plates which may be promptly removed when desired. The use of a single twin-screw for slow speeds has been tried but does not appear to have given satisfactory results, probably the resistance of the rudder and the idle screw more than counterbalancing any possible gain. A close consideration of the above points will show that the range of voyage of a war-vessel without re-coaling will depend quite as much upon its scientific handling as to its development of power and speed, as upon its original design, a a that

the captains, commodores, and admirals must be as conversant with the capabilities and scientific handling of the present gigantic floating engines comprising the war vessels of the day, as a locomotive engineer must know about his engines, their peculiarities and capabilities.

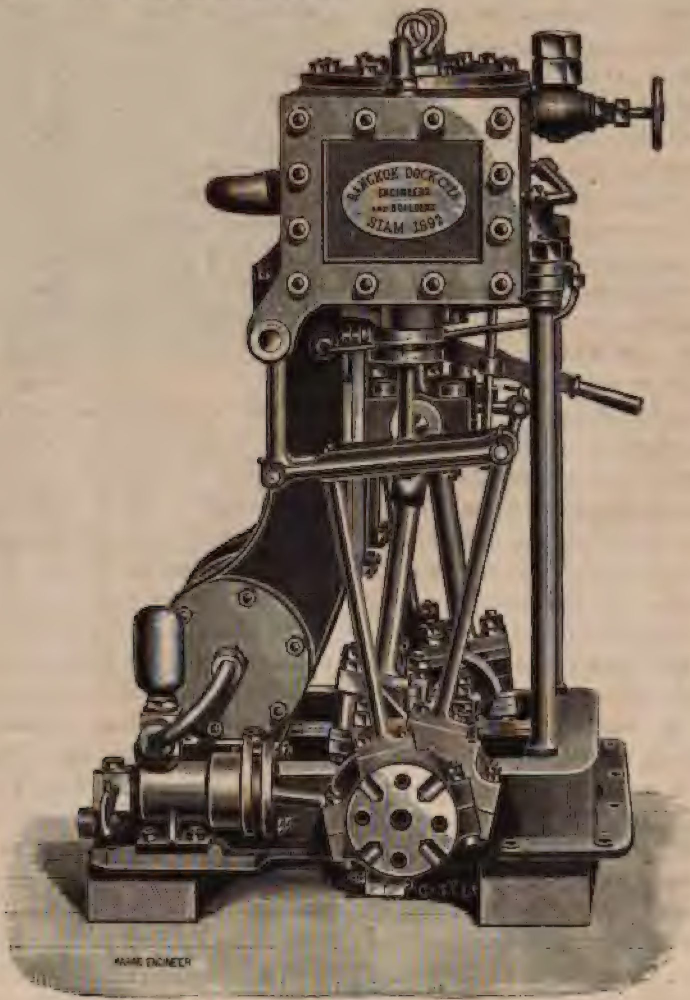
In our editorial last month we spoke of the mail delivery per *Campania* on her first eastward voyage, and compared her performance with that of the *Paris*, sailing the same day. "Time of mail delivery" is possibly a somewhat ambiguous expression. To the shipowner in these competitions it means the time when in London or New York, as the case may be, he hands over the mails to the Post Office official. To our minds and to those of business men in general, "the time of mail delivery" means the time that the letters of which the mail is composed reach our desks. Taking the deliveries in question in the latter sense—which was obviously the one in the mind of the writer—we were correct in saying that, owing, of course, to circumstances which we explained at the time the *Campania's* letters reached addresses forty-eight hours before those of the *Paris*. But when we have regard to the time when the mail reached the London General Post Office it will be found that the Queenstown route only on that occasion beat the Southampton route by something like twelve hours, the former reaching the G.P.O. at 6.41 a.m., and the latter at 6.37 p.m. on the Saturday.

The Institute of Marine Engineers celebrated, on the 8th of the past month, their third annual dinner at the Holborn Restaurant, on which occasion the President for the current year, Mr. W. H. White, C.B., LL.D., Assistant Comptroller of the Navy, and Director of Naval Construction, occupied the chair, supported by a large number of influential guests, Members of Parliament, Admirals, and Presidents of cognate institutions, and delivered a most valuable inaugural address. It is in our opinion a subject for most sincere congratulation to the young and flourishing Institute of Marine Engineers, that their status and position should have been recognised so early in their existence by the honour conferred upon them by the acceptance of the position of their President by Mr. W. H. White, who may certainly be regarded as the most influential member and leading light of so ancient and honourable a Society as that of the Naval Architects. A great change has lately come over the attitude of this old-established and eminently conservative body in their recognition of the importance of their professional brethren, the Marine Engineers, and probably that recognition could not have been more delicately and emphatically marked than by the transference to the Presidency of the younger Institute of the ex-president of the senior society. In his presidential address, the President went out of his way to emphasise the fact, that owing to the great revolution in the present method of construction of the Navy, he himself, and his colleagues of the Naval Architecture staff, were bound to be in closest association and consultation with the Engineer-in-Chief of the Navy and his staff, and that the notion ought to be entirely dismissed that any naval architect could do justice to his designs without due consideration in their very inception to the requirements, wants, and experience of the engineer. Indeed the President supplemented these views most laughably by giving some amusing details of how he sought to improve his knowledge by actual personal experience even amongst the stokers. The address is brimful of a variety of most interesting information to engineers, embodied in a clear statistical manner from the large examples and results to which the President has had access, and regretting as we do the want of space to reproduce these remarks in full, we cannot do better than recommend all our readers who had not the advantage of hearing the address delivered, to read it in detail with every attention. Mr. White traced with vigorous hand the entire revolution that had taken place in the construction of the Navy within his own knowledge. In comparing steps of progress in the iron-clad steam Navy, he pointed out that in the oldest class of iron-clads made in 1859-1861 we might see boilers carrying only 20 to 25 lbs. of steam, simple expansion engines with 350 to 450 piston speed, propelling apparatus weighing about 330 lbs. per I.H.P. and a rate of coal consumption of 5½ lbs. per I.H.P. per hour. After passing in review in similar fashion the changes of the epochs introduced in the years 1855-70 and 1870-80 and 1880-85, which each marked distinct improvements by the engineers in steam generating and propelling machinery, he brings us to the latest improvements since 1885, of triple-expansion vertical engines with steam initial pressures of 130 to 155 lbs. and piston speeds of 700 to 900 ft. per minute, and to a reduction in the weight of propelling apparatus to 260 lbs. per I.H.P. and a reduction in fuel consumption to 1¾ to 2¼ lbs. per I.H.P. per hour. He therefore credits to the Marine Engineers an intelligence and assiduity during the period from 1855 to date, which has resulted in the improvement of the engines and boilers, as regards weight of propelling apparatus to I.H.P. by an advantage of 35 per cent. and an economy of fuel in developing that power of over 65 per cent. Surely this is tribute enough to the Marine Engineers from such an authority to make them hereafter, at least a self-respecting, if not justifiably conceited community.

It is a well-known fact to all marine engineers and shipbuilders, that although the improvement and development of marine architecture is so remarkable, there is probably no class in the community more conservative, and less inclined to make bold experiments than the shipowner. What has been done has been by small degrees and slow advances. It is very little use recommending any deviation from the usual track unless it can be shown that someone else has already made the first plunge, and if there was not a few exceptions to the general rule, advance would be impossible. This is one of the reasons that so little has been done towards the introduction of petroleum as a fuel for marine boilors. Its advantages are obvious and immense. In these days of high speeds one has to remember the increasing army of stokers labouring in the heat far below the waterline. With coal, increase of speed means increase in their numbers and decrease in their—we cannot say *comforts*, but in the provision for the necessities of their existence. A proper system of liquid firing would abolish the stoking and trimming classes. In the next place it must be seen that cleaning out furnaces and getting rid of clinkers, though a very necessary process under a coal-firing system, is one which of necessity checks the steam raising power of the boiler, and at the same time tends to shorten its life, for the process lowers its temperature, and the partial cooling and reheating must set up strains upon its fabric that tend to hasten the process of decay. Economy could not fail to be promoted in many ways by such a system. Apart from the saving effected by the diminution of the engine-room complement already referred to, time and labour would be saved in the coaling process which, of course, would be effected by pumps. Then there is an economy of space, for three tons of coal are required to do the work of one ton of liquid fuel. This means in a merchant ship increased room for cargo, and thus increased carrying power, in a warship, increased radius of action. In the latter class too there is the advantage of the fact that the tell-tale smoke is abolished. There is a further advantage which practical men will appreciate in the control of the supply of fuel to the furnaces. Steam, and of course fuel would never go to waste. The flow being capable of close regulation could be adapted to the demands of the moment, and on an unexpected order to stop the fires would at once be lowered without difficulty. These are no rash assertions made on mere speculation. Liquid fuel is already in successful use for the firing of land boilers. The experiments with the steam yacht *Ruby* proved the points we have referred to, to the satisfaction of experts, including officials of Lloyd's. This little vessel was kept under continuous steam by petroleum for no less than four months. The great objection to the use of liquid fuel is of course the danger of fire. We cannot, however, believe that this is insuperable, with properly constructed and properly isolated tanks this risk should be reduced to a minimum. So much has been done of late in the construction of tank steamers for the carriage of petroleum in bulk that it should not be impossible to use our knowledge and experience there obtained for the kindred purpose of supplying vessels with safe petroleum bunkers. In some points the difficulties are over-estimated, for it is well known that a piece of white hot iron may safely be thrown into a petroleum tank. The fact is the danger is not so much from the liquid as from the vapour it gives off. This risk can be conquered by thorough ventilation. Here at all events is a field for the inventor, and it cannot be doubted that the man who introduces liquid fuel into our stokeholds will bring about many startling changes in every department of the shipping world.

Of the causes that led to the terrible disaster which has happened to H.M.S. *Victoria*, that the Navy and the nation is deploring, it is as yet too soon to speak. That full inquiry will be made into the circumstances we cannot doubt. That a lesson which has cost the nation the lives of so many brave and gallant men, and so magnificent a battleship—the latter worth in cash alone at least a million sterling, to say nothing of its protective value—will be drawn to prevent the recurrence of such an accident, is a reasonable hope. At present we can do no more than express our astonishment that with the *Camperdown* in close—alas! too close—proximity with the remainder of the finest fleet we possess, within so short a distance, it should have been possible to lose so many lives. In fifteen minutes it ought to have been possible to transfer the passengers and crew from an emigrant steamer to her own boats. How much more should it be expected that where all are men disciplined in the highest degree, with their places appointed for them to take in such an event, with the boats of the fleet coming in, it should have been possible to save the lives of all on board. The answer to this is the sudden turning over of the vessel, which must have imprisoned those below, and prevented their escape. This turning over seems to have been due to the longitudinal bulkhead system. That system is excellent in many ways, and is not to be lightly discarded, but as battleships are built to ram—and therefore to survive ramming—some plan must be evolved to counteract or minimise this risk, which is already recognized but disregarded. In so elaborate a fighting machine it should not be said that any weak spot has been left in the theory of defence. It is too early yet for us to say more than to note that the collision took

place in daylight, in calm, clear weather, and altogether under circumstances which should have made it absolutely impossible. It is our present duty to deplore with our readers the loss of two-thirds of the ship's complement of the Queen's Jubilee ship. Unlike anything else connected with our gracious and revered Sovereign, the vessel has been an unlucky one throughout. There was the trouble with her armament, the now discredited 111-ton gun. Then the disaster on striking the unchartered rock off the Greek coast at torpedo practice, and now the present final catastrophe. Whilst we grieve, as all the public—especially those who, as ourselves, are connected indirectly with the Navy—must do over so terrible a loss in all branches of the ship's complement, we point with mournful satisfaction to the fact that amongst her engineer officers, devotion to duty was as remarkable as amongst any of her crew. The proportion of loss is heaviest amongst them. On them rested the responsibility of closing the bulkhead doors. In trying to fulfil it they perished. They belong to the non-combatant branch of the service, but what has happened is one more proof of the fact that the post of danger is not always confined to the gun-deck or the bridge, and that peace has its heroes as well as war.



COMPOUND NON-CONDENSING ENGINES.

BOAT-BUILDING IN SIAM.

ON the river Meinam, in Siam, there has lately been started a new line of small steam ferry boats called the Buthmann Line.

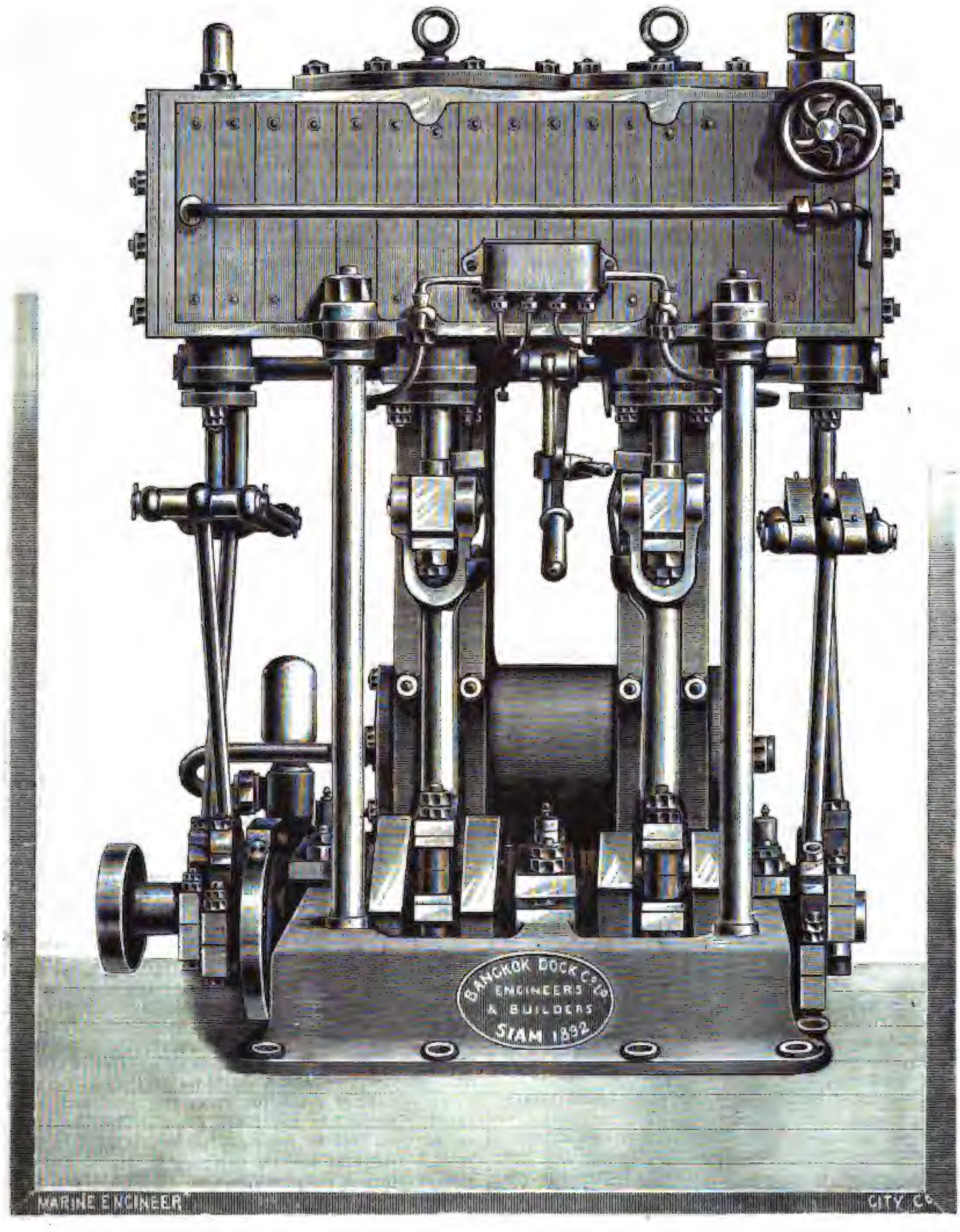
The little vessels are now running regularly from the capital, Bangkok, to several of the large native towns, both up and down the river, and are the means of conveying the mails and numerous passengers to and fro. The vessels are very popular with the natives and are admirably adapted for the service.

The eight vessels with their machinery have all been designed and built on the spot by the Bangkok Dock Co., Limited, under the superintendence of Mr. J. Mackay, M.I.M.E., and are of the very best materials and workmanship.

The frames of the boats are of native rosewood, the planking entirely of native teak, copper fastened.

The dimensions are:—Length overall in four of them, 45 ft., and in the others 50 ft.; beam, 8 ft. 6 in.; depth, 4 ft. 6 in.

9 in. diameter respectively, with a piston stroke of 6½ in. The pistons are fitted with Ramsbottom rings, and there is no unusual feature in the design of the engines, except that of the feed heater, which forms part of the back column. A spiral pipe is



Compound Non-condensing Engines constructed by the Bangkok Dock Co., Limited, Siam. (See page 138)

The machinery consists of a pair of compound non-condensing engines of the simplest and strongest construction, so as to be easily handled and repaired by the native workmen.

The cylinders are cast together, and are 5½ in. and

placed here, and all drain water is collected and pumped back to the boiler, the exhaust steam passing through the columns before entering the funnel.

The chime-bell whistles, the sight feed lubricators,

and pop safety valves, were all supplied by the Crosby Co., of London.

The boilers are of the horizontal return tube ordinary marine type, 4 ft. long, by 4 ft. diameter, built of mild steel for a working pressure of 120 lbs. per square inch.

The vessels travel about nine knots. The running expenses being very low. The cost of fuel (wood) is only 3s. 6d. per day, for each. The manager of the company, Captain Buthmann, has had great experience in this particular class of vessel and traffic.

An order for two additional boats has been placed with the same builders.

We are enabled to give our readers full outline drawings of the engines and sectional view of the hulls of the boats, with engines and boilers as fitted. We give also full lines for the drafting of the hulls and cuts from photographs of the engines in which it will be seen the valve quadrant is straight whilst that in the working drawings is radial. It appears that some of the engines were made with straight quadrants, and some with radial. The view taken from a photograph of the boat afloat with passengers aboard gives a vivid idea of the appreciation of the natives for the passenger service carried on by these boats, and show a neat and graceful turnout.

INSTITUTE OF MARINE ENGINEERS.

The third annual dinner of the Institute of Marine Engineers was held on the evening of June 7th at the Holborn Restaurant, when the President of the Institute, Mr. W. H. White, C.B., LL.D., Assistant Controller of the Navy and Director of Naval Construction, occupied the chair. The company, which numbered about 250, included Sir Fredk. Bramwell, Sir A. S. Haslam, Sir T. Sutherland, K.C.M.G., M.P., Sir E. Harland, M.P., Admiral Sir V. Hamilton, K.C.B., Admiral C. A. Bridge, Admiral C. Domville, Captain Johnson, Captain W. R. Martin, Mr. R. Thompson (President of the North-East Coast Institute of Engineers and Shipbuilders), Mr. J. Cory, Mr. John Glover, Mr. E. C. P. Hale, Mr. J. Vicavo, Mr. A. Kiddell, Mr. A. S. Williams, Mr. W. Richardson, Mr. H. M. Christie, M.A., F.R.S. (Astronomer Royal), Professor Biles, Mr. W. Allan, M.P., Major S. R. Jones, M.P., Captain Blackmore, Captain Froud, Mr. H. E. Deadman, Mr. J. Dunn, Mr. R. J. Butler, Mr. J. H. Morrison, Mr. J. Williamson, Mr. A. J. Durston, Mr. P. Denny, LL.D., Mr. B. Martell, Mr. Alderman Kidd (Mayor of West Ham), Mr. J. Inglis (President of the Institute of Engineers and Shipbuilders in Scotland), Captain Angove, Captain Hodgkinson, Captain Hutchinson, Mr. G. W. Manuel, Mr. J. M'Farlane Gray, Mr. F. W. Wymer, Mr. J. A. Rowe, Mr. J. H. Thomson, Mr. R. Leslie, Mr. W. J. Craig, Mr. J. Nicholls, Mr. Fortescue Flannery, Mr. A. Beldam, Mr. C. G. Newby, Mr. H. Joyce, Mr. W. C. Roberts, Mr. F. W. Shorey, Mr. A. W. Robertson, Mr. James Adamson (Honorary Secretary), &c., &c.

After an excellent dinner the Chairman proposed the customary Royal toasts.

Sir A. S. Haslam submitted "The Navy, Army, and Reserve Forces," Admiral Sir Vesey Hamilton responding for the Navy and Army, and Mr. W. C. Roberts, R.N.R., for the Reserve Forces.

PRESIDENT'S ADDRESS.

The Chairman then proceeded to deliver his presidential address, and, after some introductory remarks, he said: At the outset I desire to express my full appreciation of the honour you have bestowed by electing me as President of the Institute. It is no easy matter to follow my predecessors in this chair; but I may claim an equal desire to promote the best interests of the Institute, and assure you of my readiness to serve it to the utmost extent possible.

PROGRESS OF STEAM NAVIGATION.

The addresses delivered by my immediate predecessors have largely consisted of personal reminiscences of the earlier periods of steam navigation. Besides their great interest as records of facts, these addresses, in years to come, will be of high historical value. My acquaintance with the progress of steam navigation does not extend over so long a period as theirs, and my experience has been chiefly gained with warships. Were it desirable, however, I could describe advances and improvements of the most notable character made since 1859, when, as a boy, I entered the Admiralty service. Ships dependent upon sails alone for propulsion were then on service in the Royal Navy. With feverish haste the steam reconstruction was being carried out. Ships built for sailing were being "converted" into screw steamers; new steamships were being laid down. The paddle-wheel occupied a prominent position as a propeller. Sails were considered a necessity, and steam treated as an auxiliary method of propulsion. Wood was the material almost universally used in warship-building. Against strong opposition from high naval authorities the first steps were being taken in the ironclad reconstruction. Smooth-bore guns and primitive mountings continued to be the armaments. Since the date I have named I have witnessed, and to some extent assisted in, a series of transformations more rapid and remarkable than anything to be found in the four centuries which practically cover the history of the Royal Navy. We have passed from wood to iron, and thence to steel, as the material for hull structures. Sail power has practically disappeared in most classes of warships. Steam power has been frankly accepted as the sole means of propulsion, and safety guaranteed by duplicating the machinery and propellers. Steam pressures have been increased from 20 or 25 lbs. per square inch to 160 or 180 lbs. The box-tubular boiler has given place to the cylindrical type in general service; while the modified locomotive type has been extensively used in special classes of swift small vessels, and the "water-tube" type is now becoming a serious competitor. Jet condensers have been succeeded by surface condensers. Simple-expansion engines have been followed by compound and triple-expansion. The horizontal type of engine has almost ceased to be used, and the vertical inverted-cylinder type substituted. Piston speeds and rates of revolution have been greatly increased. Improved materials and designs have enabled great economies in weight to be effected in proportion to power developed. The rate of coal consumption has been diminished by about two-thirds. Steam has been applied to auxiliary machinery of all kinds, and manual labour reduced proportionately. Hydraulic and electrical machines have been introduced for working guns, lifting heavy weights, steering, and other purposes. Electric lighting has become general. Air-compressing machinery of considerable power has been rendered necessary by torpedo armaments. Heavy guns have been mounted with special mechanical arrangements for training, elevating, and loading. The lighter guns, worked by manual power, are of novel types, and carried on special mountings with complicated and delicate mechanisms; and the ceaseless struggle between guns and armour has been carried on.

DEVELOPMENT OF ENGINEERING IN THE ROYAL NAVY.

Confining attention to the engineering side of this series of rapid changes, it is interesting to note that an epitome of the history of progress is to be seen in ships still on the active list of the Royal Navy. The iron and steel hulls of these ships, treated as they are, seem practically indestructible. It has been decided, therefore, to maintain a considerable number of the earlier types as a reserve force, which would be available should the chances of war put out of action for a time the newer and more powerful types. Ships like the *Black Prince*, *Achilles*, and *Minotaur*, dating from 1859-61, are included in this list. In them are to be seen box-tubular boilers, carrying 20 to 25 lbs. of steam, jet condensers and simple-expansion engines. The piston speeds are about 350 to 450 ft. per minute, the propelling apparatus in full working order weighs about 400 lbs. per H.P. (indicated on the contractors' trials), and the rate of coal consumption is about $5\frac{1}{2}$ lbs. per I.H.P. per hour. As a first step from these vessels we may pass to ships like the *Monarch* or *Hercules* (1865-70), with surface condensers, 30 lbs. to 35 lbs. steam pressure, piston speeds of 500 to 650 ft. per minute, and the horizontal simple-expansion type of engine. The propelling apparatus weighs about 330 lbs. per I.H.P., and the rate of coal consumption is about $3\frac{3}{4}$ lbs. per I.H.P. per hour. Ships built 10 years later (1870-80) have compound engines (either horizontal or vertical), cylindrical boilers.

STEAM FERRY BOATS BUILT BY THE BANGKOK DOCK CO., LTD., SIAM. (See page 188.)

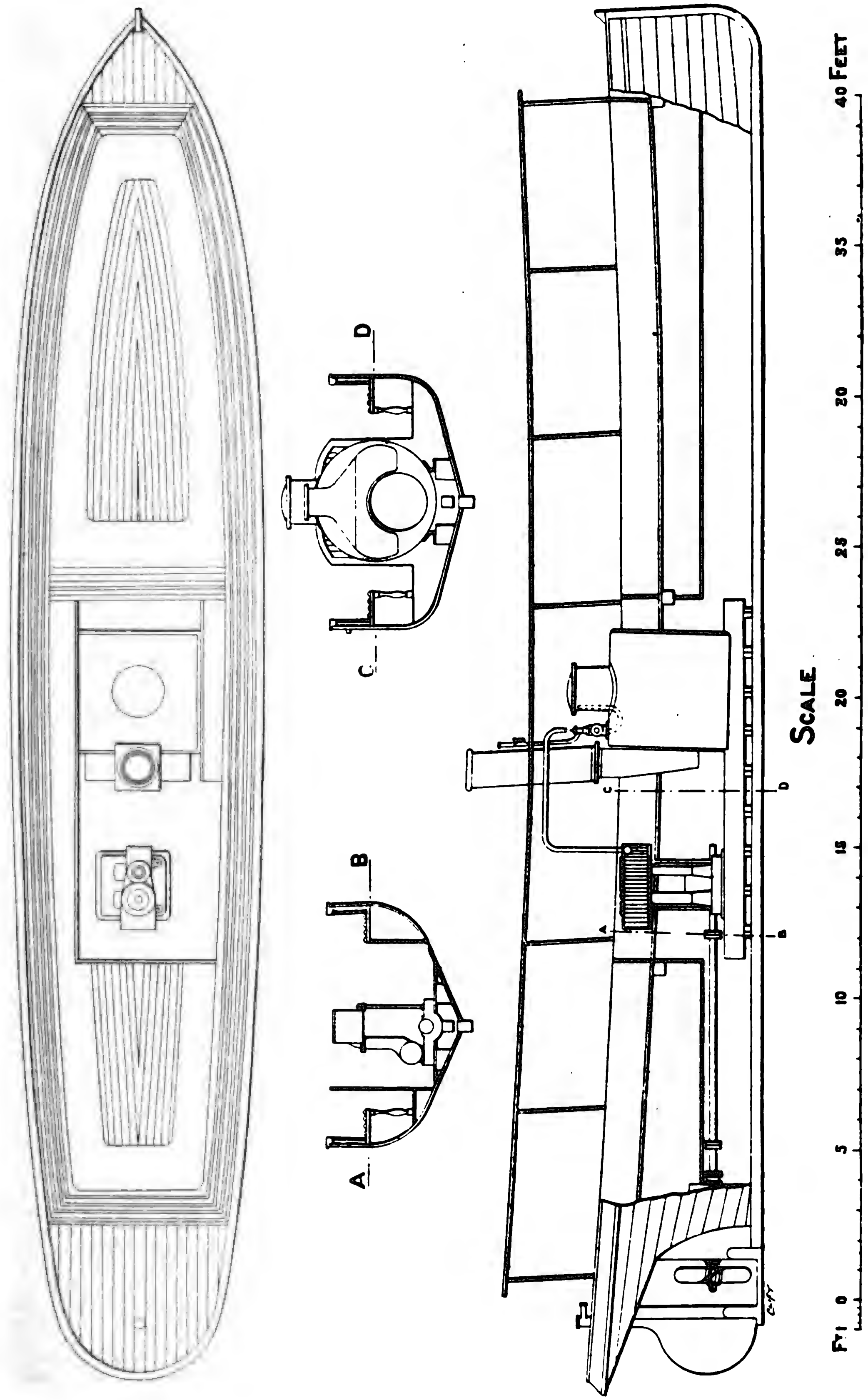
with 60 lbs. to 65 lbs. steam pressure, and about the same piston speeds as their immediate predecessors The average weight of the propelling apparatus is a little greater, about 360 lbs. per I.H.P. developed on contractors' trials, but the rate of coal consumption is about 25 per cent. less. Later examples of the compound type (built from 1880 to 1885), with steam pressures of 90 to 135 lbs., and piston speeds of 600 to 800 ft. per minute, showed a further saving of about 14 per cent. in weight, and 9 per cent. in rate of coal consumption. Since 1885, with triple-expansion vertical engines, steam pressures of 130 to 155 lbs., and piston speeds of 700 to 900 ft. per minute, the weight of the propelling apparatus has been reduced to 260 lbs. per I.H.P. on the eight hours' contractors' trials, and the coal consumption at full continuous steaming has become 1¾ to 2¼ lbs. per I.H.P. per hour. Since 1859, therefore, the proportional weight of propelling apparatus to power indicated has been reduced about 35 per cent., and the rate of coal consumption over 65 per cent.

WARSHIP V. MERCHANT SHIP MACHINERY.

In passing it may be well to give a brief explanation, which may remove a very common misapprehension. Warship machinery is often spoken of as unduly light for continuous steaming at high speeds, and as distinctly inferior in this respect to merchant-ship machinery. Of course, there are many varieties of merchant-ship machinery, and to make a fair comparison one should take swift passenger steamers rather than cargo steamers. I have recently looked carefully into this matter on the basis of trustworthy information furnished confidentially by friends in the mercantile marine, and the results are interesting. The first point to be mentioned is the confusion that has arisen from the different modes of estimating the H.P.s to be equated to the weight of propelling apparatus in war and merchant ships. All the figures I have given above are for contractors' trials of warships. These trials are made over limited periods (eight hours at present). with good coal, skilled stokers, and everything in the best order. They are perfectly fair and absolutely necessary for comparative purposes, and for guidance in future design. No one imagines, however, that they are representative of ordinary service conditions as regards the development of power for continous steaming over long periods at sea. The Admiralty practice is to regard 60 per cent. of the power developed on the eight hours' contractors' trials as the minimum which should be obtained in smooth water steaming at sea for long periods. As a matter of fact, in many cases this minimum is exceeded, and 80 or even 100 per cent. of the power developed on the contractors' trials has been obtained on trials lasting three or four days with the ordinary complement. Taking 60 per cent. as the standard, it will be seen that the average weights of modern machinery and boilers in recent war ships, amount to about 460 to 470 lbs. per H.P. This proportion of weight to power will be found to compare very well with the corresponding proportion in swift merchant steamers of recent design, taking for the latter the average power indicated on service. In short, the prevalent idea of the exceptional lightness of warship machinery is largely due to a confusion as to the basis on which the power-development is measured. In warships the accepted standard is the contractors' trial; for merchant ships it is the average performance at sea. Another point of practical importance in the comparison of warship and merchant ship machinery is the great range of power over which the former has to work, while the latter is worked under fairly uniform conditions. Speaking broadly, and apart from the interference of wind and sea, a merchant ship is worked at a constant speed and power. Everything can be adjusted to secure economy under these approximately constant conditions. In this audience it is unnecessary to dwell upon the great advantages arising from working under such circumstances, as compared with the varying conditions of the warship. The latter ordinarily cruises at low speed, developing not more than 10 to 15 per cent. of her maximum power, but she must retain the capacity for attaining full speed when required. Take, for instance, a first-class cruiser which attains a speed of 20½ to 21 knots on her eight hours' contractors' trial, developing about 14,500 H.P. On ordinary cruising service she would proceed at 8 to 10 knots, and require not more than 1,000 to 1,500 H.P. At full sea-speed under ordinary service conditions she might develop about 9,000 H.P. and steam 18 knots. Compare this with a trans-Atlantic steamer employed on a definite route, and intended always to complete her passage at the highest speed compatible with the conditions of wind and sea. It is obvious that in the warship less economical results must be obtained at ordinary working speeds, and that both in the design and management of the machinery special difficulties must be met. In the matter of coal consumption this is specially felt. As a rule, the rate is higher in warships than in merchant ships, although there are instances where warships making long passages at high speeds have closely approached the best results claimed for merchant steamers. Another point deserving notice is the essential difference arising from the fact that the warship is primarily a fighting machine. Its propelling apparatus must be protected, and the arrangements of engines and boilers have to be controlled to some extent by considerations of offensive and defensive features in the design, Here, again, the popular view is incorrect.

THE NAVAL ARCHITECT AND THE MARINE ENGINEER.

It has often been my fortune to read criticisms of our warships, in which it was alleged that no proper regard had been paid to the conditions requisite for efficient working of the machinery and boilers. To read these effusions one would imagine that all other claims were paramount to the requirements of the marine engineer. The naval architect is supposed to arrange for the protection, the armament, the speed, the coal supply, and the accommodation for the crew, assigning to the unhappy designer of the engines in an arbitrary fashion certain limited and inconvenient spaces, with a demand that into them shall be crowded engines and boilers developing a certain power, and not exceeding a certain weight. In some cases where difficulties have arisen or accidents occurred, the sole and sufficient explanation has been found by these omniscient critics in the confined nature of the spaces in engine-rooms or stokeholds, even when the explanation had no more bearing on the troubles than would the size of the kitchen have had upon the explosion of the boiler in a cooking-range. All this is pure nonsense. I have spent my life in designing warships both inside and outside the Admiralty service. My experience has brought me into the closest intimacy with marine engineers engaged in the design, the manufacture, and the management of propelling machinery. I speak but the common experience of all naval architects when I say that in all stages of the design we are working with our colleagues, the engineers, on the best understanding and the closest association. Our aims and interests are identical: to produce ships which shall fulfil the intentions of the design, and be efficient, safe, and seaworthy. One of the earliest and most important features of a design is, of course, the determination of the power required for attaining the desired speed, and the settlement of the type of engines and boilers, the spaces for their accommodation, and the corresponding weights. The critics seem to think that all these matters are treated as mere afterthoughts; that we resemble the architect who completed his design for a mansion without providing a staircase. They only demonstrate by their attacks their complete ignorance of actual procedure. My friend and colleague, the Engineer-in-Chief of the Royal Navy, will bear me out in this statement, and so will all the makers of marine engines who are familiar with warship design. What is true, and probably underlies most of the statements to which I have referred, is that in recent years the introduction and development of swift torpedo vessels of very small size has resulted in the demand for very high speeds in warships of small dimensions. This demand has come from tacticians and naval officers, not from naval architects. In attempting to meet these demands, naval architects, as well as marine engineers, have had to face great difficulties. The cry is for greater speed combined with powerful armaments, good coal supplies, and moderate dimensions. Much has been done towards meeting this demand, but I have not time to dwell upon details. Higher speeds demand greater engine powers, and the limitation of dimensions necessarily imposes restrictions on space and weight. The marine engineer has done wonders in meeting these new conditions. By improvements in design, higher steam pressures and greater expansion, better materials and better distribution of materials, increased piston speeds and rates of revolution, new types of boilers, and new or modified systems for assisting natural draught, as well as by close attention to details and auxiliary appliances, the proportion of power to weight and space has been increased. The pioneer work done in torpedo craft by Thornycroft, Yarrow, and others, has greatly aided this progress; but to a large extent it has been beyond precedent, and, therefore, experimental. On the whole, it has been successful, although it may be frankly admitted that there have been some serious difficulties with boilers, and in some cases,



Sectional View of Steam Ferry Boats. (See page 138).

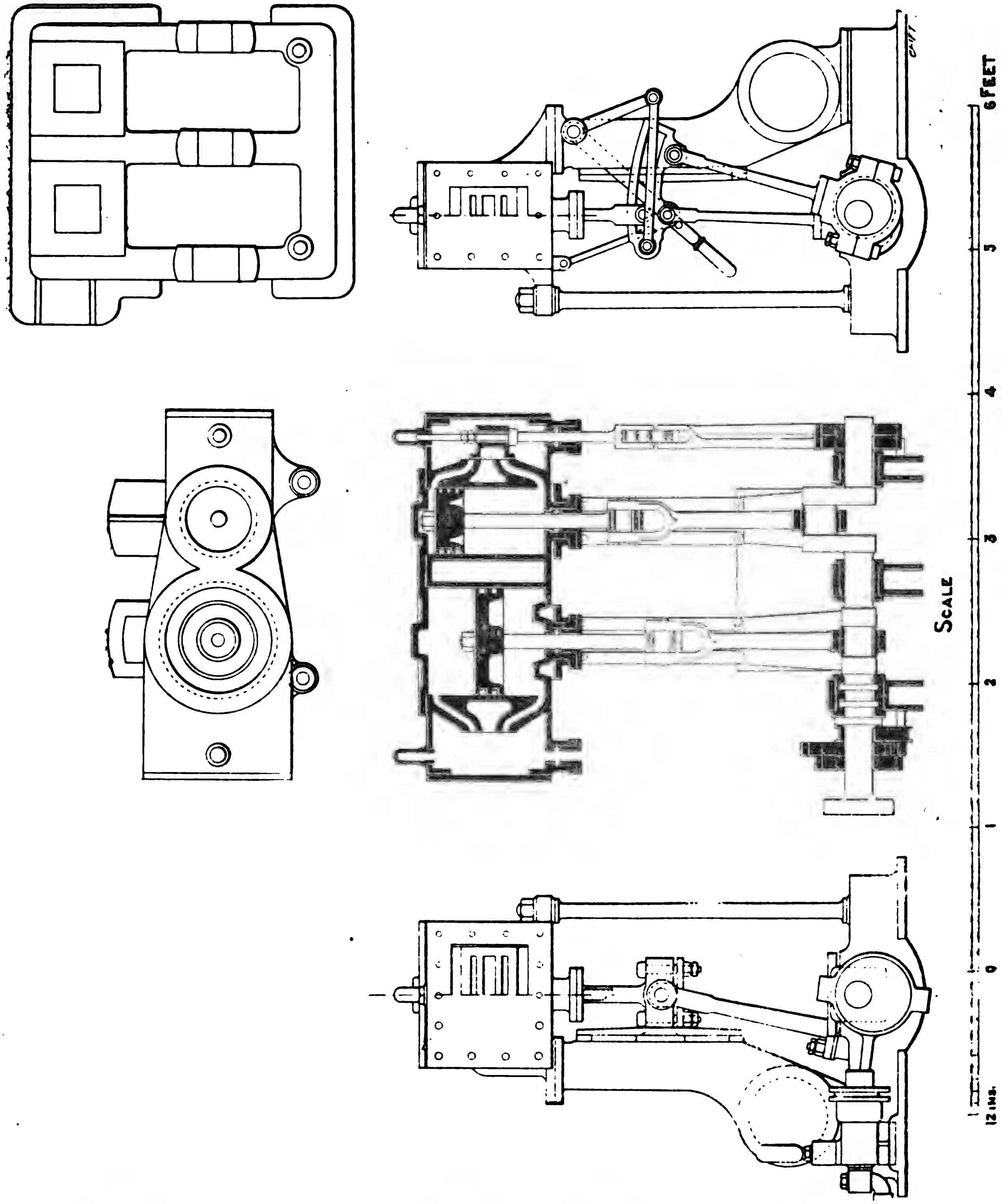
too sanguine an estimate of the power which could be obtained with certain boilers. These difficulties have been overcome to a great extent, and the position has been greatly improved. They have necessarily directed attention to alternative types of boilers, and so out of a temporary check further progress may arise. Apart from experiment, progress is impossible. Due precautions are desirable, of course, in making experiments not to go too far or risk too much. It cannot be said that this has been done in the Royal Navy, or that in any instance the power ultimately realised, even if it fell short of the first estimate of the designers of the machinery, has not been large in relation to the weight. Apart from development of power, the intended speeds could not be secured, of course; but instances of this kind have not been numerous, and recent practice has been entirely satisfactory. On the side of the naval architect much has been done towards securing these high speeds in small vessels. Improved forms have been devised, diminishing resistance. New structural arrangements have been introduced economising weight. Failure has been predicted for these so-called "flimsy structures," and the critics have in some cases been so early in the field as to record the "shaking to pieces" of ships by their powerful machinery before the engines have moved even at moorings. As a matter of fact, there has not been a single instance of serious working or weakness; and examples of the lightest-built and most high-powered types have now been subjected to crucial tests on actual service. I have dealt at some length with these allegations of the evil conduct of the naval architect in cramping and crippling the marine engineer and in attempting to crowd "a quart into a pint pot," because this seemed a fitting place and occasion to state the facts. There is and can be no opposing interest between the designers of ships and engines if the best results are to be obtained. The naval architect did not attempt to deal with questions relating to the design and manufacture of marine engines, but he must be conversant with the great principles of engineering and their latest embodiments in design. He must also have a knowledge of the requirements of the engineers serving afloat in charge of the machinery of the ships he designs. For this purpose some experience afloat is desirable, and, speaking for myself, I can say that the too-brief periods I have spent on board ship have been of the greatest service. Intercourse with engineer officers, and time spent in engine-rooms and stokeholds have added to my knowledge of what is essential to efficiency, and to my practical sympathy with the engine-room staff in their onerous duties. It was with much amusement, while I was afloat during the manœuvres of 1889, that I read in some newspaper an article contributed by a correspondent—himself, I believe, a retired engineer—and found the expression of a hope that I might take a turn as an amateur stoker, and learn the truth as to the bad conditions under which the work had to be done. As a matter of fact, I had already spent a considerable time with the stokers, although I cannot claim to have taken charge of a fire, and probably knew more of the real conditions than the gentleman who was so desirous that I should improve my information. One great lesson I have learnt from these occasional cruises is, that well-considered arrangements for the supervision of the whole engine-room and stokehold departments is essential to the best results in propulsion. In our designs for warships these points receive the closest attention from my colleague the Engineer-in-Chief and myself. The spaces assigned to engines, boilers, and coal, the means of communication between them, the ventilating arrangements, the stowage and transport of coal, and other features affecting efficiency are all most thoroughly studied. We recognise that it is our duty, so far as may be possible, consistently with other requirements, and especially with that minute water-tight subdivision which is requisite in all warships, to do all in our power to facilitate the performance of the responsible duties which devolve upon the engineer officers and their subordinates. I am glad to be able to add that the reports received from ships of recent construction on these points, after experience in service, have been favourable. They show that the arrangements made secure the power of maintaining relatively high speeds for long periods, working under ordinary conditions and with the regular staff in three watches.

RESPONSIBILITIES OF SEA-GOING ENGINEERS.

When dealing with the remarkable progress in marine engineering, and the resultant economies in weight and coal consumption, it must never be forgotten that these results depend upon skilful and intelligent management as well as upon design and manufacture. Marine engines are not automatic machines, workable on the "penny-in-the-slot" principle, after they have been once erected and set to work. Their continued efficiency demands constant care and attention from those in charge. Without proper management the most perfectly-designed and manufactured propelling apparatus may give results inferior to those obtained with less perfect apparatus. The "human factor" is, in short, most important. All progress in marine engineering increases this importance and places heavier responsibilities upon sea-going engineers. Speaking here, and to an Institute whose members are personally interested in the management of marine engines and boilers, I need not emphasise the fact, which will appear to be a mere truism, although like other truisms it is sometimes forgotten. Economical propulsion in every ship depends upon the faithful and efficient performance of duty by every member of the engineering staff. Someone has remarked that success ultimately depends upon the stokers who put coals upon the fires. Recent action by your council in connection with the certification of competent firemen recognises the force of this observation. But it is equally true of every member of the staff, and applies to all ships although not to the same extent. Efficient organisation and supervision under a competent chief are always necessary, but they are of supreme importance when ships have very high speeds and the propelling machinery is of enormous power. It is no disparagement to the general ability of marine engineers to say that not all of them possess those qualities of organisation and control of men which are essential to successful working in steamers developing 20,000 to 30,000 H.P. But it is as true of the engineer serving in a "tramp" steamer as of one serving in an Atlantic liner or a first-class passenger steamer on any other route, that as improvements are made in the types of engines and boilers, so it is necessary for proper management that he should add to his knowledge in order to obtain the best results. One of the principal aims of this Institute I understand to be to aid in such self-improvement. The original scheme includes "the encouragement of original and improved methods of working, or arrangements of machinery to produce better results." During the four years of its existence the Institute has done good service in this direction by means of the papers and discussions contributed to its "Transactions" and the intercourse it has encouraged between engineers. We may be sure that its influence will increase in future, and always tend to raise the standard of knowledge and efficiency among its members.

EFFICIENCY OF MANAGEMENT AND RESULTS.

The extent to which differences in efficiency of management may affect results, especially in regard to coal expenditure, may be briefly illustrated. The facts are largely drawn from warships, but they admit of general application. A ship was tested over a long distance very early in her commission to determine her rate of coal consumption at 10 knots. After being in commission nearly three years the trial was repeated. Enlarged experience in management effected a saving of one-third in the rate of coal consumption. This ship had triple-expansion engines, so that at first the results obtained were no better than those which compound engines should have given. A sister ship in her first commission obtained as good results as the other reached finally. Two sister ships of another class built and engined by the same firms made a long passage in company when first commissioned. One burnt 10 per cent. more coal on the voyage than the other. Two other sister ships, not engined by the same firm, but with similar engines and boilers, showed a difference of 20 per cent. in their rates of coal consumption when indicating the same power on about the same distance continuous steaming. A first-class passenger steamer on her trial trip attained her speed of about 20 knots, with about 80 revolutions of the engines per minute. On her earlier voyages the revolutions averaged about 65, and the speed about 16 knots. Subsequently speeds and revolutions were obtained on service closely approaching the trial results. A change of propeller partly accounted for the improvement; but there can be no doubt that experience and better organisation had a great influence. Torpedo vessels, with their very quick running engines and special types of boilers, afford notable examples of the necessity for exceptionally skilful management in order to attain maximum results. It is possible in a boat with one large boiler worked by specially trained men to obtain results not to be repeated with a group of similar boilers in a larger vessel. For instance, with a single large locomotive boiler working under a certain air-pressure in the stokeholds, and supplying



COMPOUND NON-CONDENSING ENGINES CONSTRUCTED BY THE BANGKOK DOCK CO., LTD., SIAM. (See page 138.)

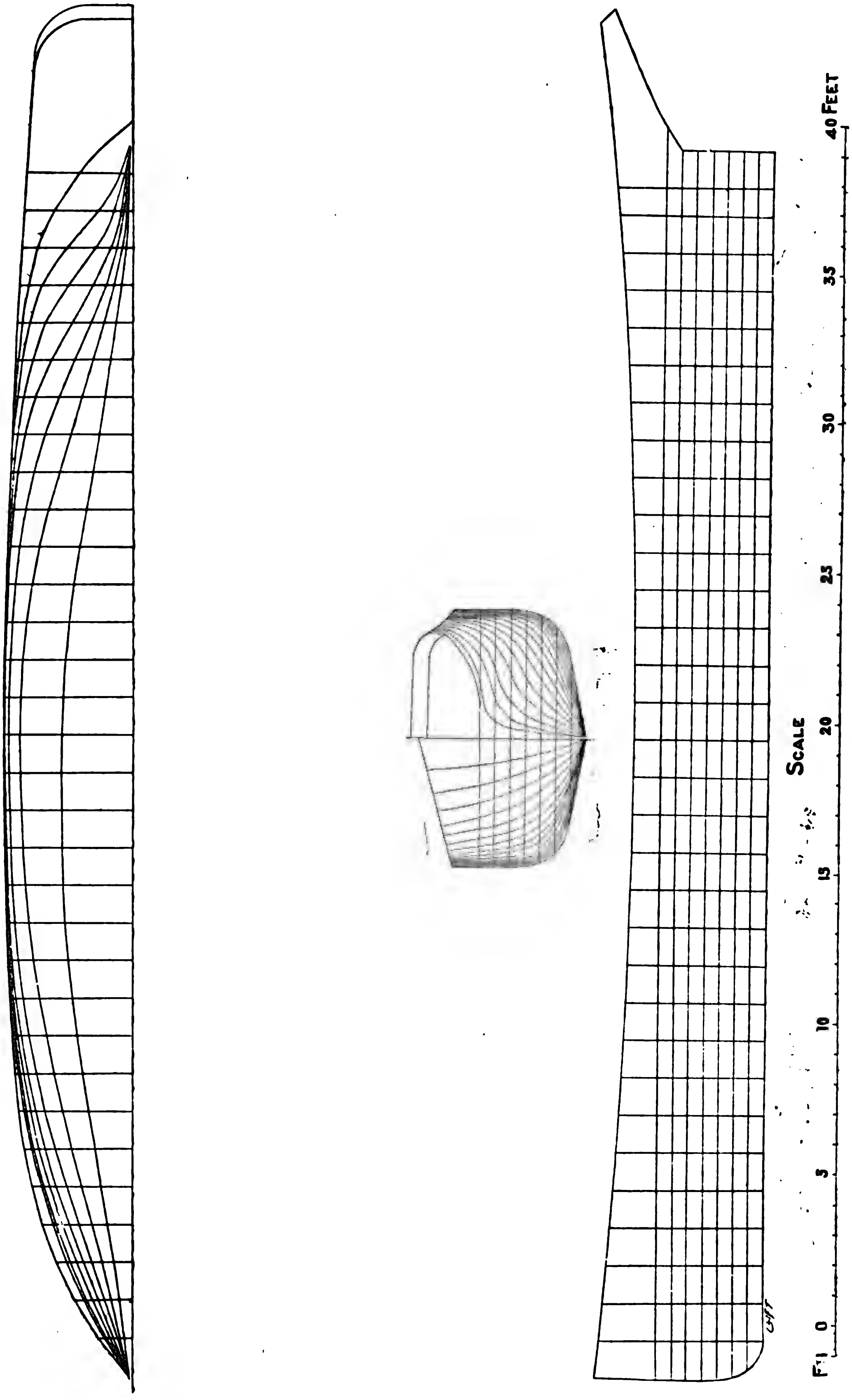
steam to triple-expansion engines about 50 H.P. have been obtained per ton of boilers, &c. With a group of four similar boilers about two-thirds as much power per ton has been obtained. With water-tube boilers it is claimed that about 65 H.P. per ton of boilers, &c., has been obtained from a single boiler without distressing the boiler; but with groups only about two-thirds as much. Here management has been the most potent factor in difference of results. Mr. Yarrow informs me that with higher air-pressures in the stokeholds and a single locomotive boiler he has obtained as much as 69 H.P. per ton of boilers and water in boilers on trials of short duration. The highest development with cylindrical boilers, worked under forced draught for three or four hours has been from 20 to 25 H.P., or about one-third only of the results claimed for single locomotive or single water-tube boilers, and about two-thirds the results claimed for groups. Taking the aggregate weights of propelling apparatus in a topedo boat with a single locomotive boiler worked under considerable air-pressure, an I.H.P. is obtained over short periods for an expenditure of 60 to 80 pounds only. In a torpedo gunboat with a group of locomotive boilers and worked under more moderate air-pressure, the corresponding weight per H.P. is 150 to 180 lbs. These figures when compared with those previously given for warships with cylindrical boilers and triple-expansion engines will indicate both the necessity for specially-trained engineers and stokers in the torpedo vessels, and the manner in which the exceptionally high speeds are secured. As an extreme contrast, take the case of a torpedo boat of about 100 tons displacement, about 22 knots speed, and 1,000 H.P., and compare her with a cargo steamer of 4,500 to 5,000 tons displacement, with engines of about the same power, giving a sea speed of 9½ knots. The cargo steamer "threshes" along over long distances, making about 65 revolutions a minute, and her propelling apparatus weighs about 260 tons. The torpedo-boat engines make about 400 revolutions per minute, and in working order the whole propelling apparatus weighs about 35 to 40 tons. She can steam long distances at 10 knots, more moderate distances at higher speeds, but can only maintain her maximum speed for three to four hours. Obviously the engineers of the cargo steamer would not be much at home in the torpedo boat and the torpedo-boat staff would feel strange on board the cargo steamer; but the latter would have the less difficult task in settling down in their new surroundings.

THE DEMAND FOR HIGHER SPEEDS.

We are not yet at the end of our resources in regard to the construction and propulsion of steamships if the demand for higher speeds arises. There is no reason for thinking that our present position is a final one, or that progress is to be arrested at the point we have reached. Commercial considerations for merchant ships, and other considerations in war fleets, will determine what the steamships of the future shall be. If the cost is not thought too great, naval architects and marine engineers will undertake to meet the conditions. Already we have better materials than mild steel in view, and metallurgists have not said their last word. Various alloys of steel, aluminium, and other materials will give the possibility of a better association of strength with lightness and freedom from corrosion. With these new materials, improvements in structural arrrangements and engine design will be possible. A more certain knowledge than heretofore is now attainable, by means of model experiments, respecting fluid resistance at unprecedented speeds, and the causes influencing the efficiency of propellers. "Rule of thumb" has given place to scientific procedure. New descriptions of boilers are being introduced. Liquid fuel may become a possible substitute for coal in vessels of exceptional speed, and may lead to large economies in weight of fuel. The results attained in torpedo boats are object-lessons and model-experiments which will be of inestimable value to those who may be called upon to deal with higher speeds in larger vessels. According to the law of "corresponding speeds," 20 knots in a first-class torpedo boat gives us information respecting the phenomena of fluid resistance at speeds of about 50 knots in a steamship not exceeding in displacement existing vessels: warship construction in the cruiser classes has given further information of a most valuable character. Cruisers of 3,000 to 3,500 tons displacement have been driven at speeds of 20 to 23 knots, corresponding to speeds of about 26 to 30 knots in ships of the size of existing Atlantic liners. Whatever further progress is made this may be confidently predicted. As the sizes, speeds and engine-powers of ships increase, so must the responsibilities of the officers in charge be enlarged. In the engineer's department this must be true, even if new fuels are employed, and new types of machinery and boilers devised. There will be an increasing need, therefore, for this Institute, with all its educational appliances. It will be equally true also of the officers responsible for the navigation, and I am disposed to think that in this respect the influence of the "human factor" will make itself felt on the average speeds attained. Torpedo boats which can steam 20 knots in smooth water have to be slowed to 10 or 12 knots in a channel gale; they have the power for higher speeds, but it is not wise or safe to drive them hard against the sea. Existing ships of large size meet with conditions of weather where the same thing is true, and the engines must be slowed. Probably the larger and longer a ship is, the higher is the limit of speed, at which it becomes impossible to force her against wind and sea. Increase in size and speed have so far come by gradual steps, enabling experience to be gained, and this will probably remain true from considerations of a practical nature. Many of the schemes one hears of for vessels of surpassing speed ignore these considerations of what a man can control or sustain, and what the structures of ships can withstand. In practice, however, they must not be overlooked; and we may hope that in the never-ending rivalry for supremacy at sea, for purposes of peace or war, these qualities of our race which have kept us to the front up to the present time will continue to be operative.

Mr. Peter Denny, LL.D., then proposed the toast of "The Shipping Interest." He said that allusion had been made by a previous speaker to the high and proud position which the army and navy had assumed in preserving the integrity of this great empire. He (Mr. Denny) claimed that those engaged in the shipping interest had also contributed in a very important degree to the building up of this empire and to its commercial prosperity. But for the enterprise of those engaged in shipping, this country would have been left very ill provided in many ways with the necessities of life. That this great interest had not always received the encouragement which it might and should have received from successive governments was a notorious fact. Instead of receiving assistance it had been the subject of harassing legislation. Bills had been introduced by men who knew nothing about the management of ships, and who certainly had no financial interest in ships, or they would have been much more careful in their acts. He was sorry that he could not speak in a very cheerful tone of the present position of shipping. Why the prevailing depression had come about he could not say. Whether it was due to overbuilding, or had been induced or aggravated by the general depression of the times, he would not attempt to decide, but as an engineer he might perhaps plead guilty, with many others engaged in that business, to the introduction of the triple-expansion engines; and it might have been a better thing for the shipping of the present day if engines of that class had not been introduced. It brought into the competition an entirely new type of steamer, and no doubt a better type; and in the race for business such enterprising gentlemen as were engaged in the shipping trade were not content to be left one behind another. The harassing legislation to which he had referred was not the legislation of any one Government. The late as well as the present Government tried its prentice hand, and a nice job they made of it. What changes or proposals were in store for the shipping trade in the future it was impossible to say. They had it on the authority of the late Lord Beaconsfield that the unexpected always happened, so that they had better keep their powder dry. "Hope springs eternal in the human breast," and although hope might not fatten it would make them more cheerful. He trusted that the shipping trade would experience a speedy revival, and heartily wished it great success. He coupled with the toast the name of Mr. John Glover.

Mr. John Glover, in responding, said Dr. Denny had spoken some words of hope about the shipping interest. He (Mr. Glover) would not be so bold in the company of a body of engineers as to say much as to the causes of the present condition of things, but he might perhaps just give a hint that if, in the next year, shipbuilders would build fewer ships and engineers would make fewer engines, the shipping trade might have better times. If the production of shipping continued at the same rate as in the last three years, during each of which a million and a quarter tons of shipping were put into the water, they must expect disaster. All they wanted to bring about an improvement in the trade was not that shipbuilders should close their yards, but that they should slacken their pace a little.



Boat Building in Siam (*See page 138*).

Mr. A. Beldam proposed "The Houses of Parliament," and said he did not intend referring to what had transpired during the present session, but he might be allowed to state that in his opinion there never was a time when it behoved members of the House of Commons, and also their constituents, to show more loyalty to the Queen and country than at the present day. He had to couple with the toast the names of two gentlemen—Sir Edward Harland and W. Allan, who were universally known in the shipping world, and in honouring the Institute with their presence they showed their sympathy with the Institute and its work. Indeed it would be impossible to find any members of the House of Commons whose interests and sympathy were more in common with those of the members of the Institute of Marine Engineers than these two gentlemen. Moreover, both gentlemen were intimately connected with the profession of marine engineering. Sir Edward Harland was at the top of his profession as an eminent shipbuilder, and Mr. William Allan was not only an eminent marine engineer, but, he believed the only marine engineer who had a seat in the House of Commons.

Sir Edward Harland briefly replied, as did also

Mr. Allan, who, in the course of a humorous speech, said that in his mind an engineer could never make a politician. He was far too practical to be a politician. He was always too anxious to make a good job of whatever he undertook, and was also anxious when he once began a job to get it finished. As an engineer he (Mr. Allan) had found himself in a very awkward position. He looked upon the House of Commons as a huge multiform gas-engine—and the working of this engine proved exceedingly jerky, spasmodic, and fitful. This arose from its ability to perform the minimum amount of work considering the great amount of energy that was put into it, and if their esteemed President would calculate out the daily diagrams taken from the House of Commons he would find that the power was not at all commensurate by the terrible amount of gas used. The gentlemen who attended upon this huge gas-engine were not called engineers; they were called members, and they all differed as to how the engine should be run, the result being that it did not get away at all. The members of the House of Commons, or the engineers of the gas engine, were a decent lot of fellows, but the great secret of the matter was that the real work was not done in the House of Commons at all. There were a number of gentlemen outside the House of Commons who practically carried on the work of the country, and one of the chief of these was the gentleman who occupied the chair on the present occasion. The one great element necessary in a gentleman to qualify him to hold a position in the Ministry was the initial ignorance of the job he was going to undertake. They would never, for instance make him (Mr. Allan) Secretary to the Admiralty, and if any gentleman present had a Parliamentary ambition, and wanted a job, he must take warning that he must know nothing about that job.

Sir Thomas Sutherland, M.P., then proposed the toast of the evening—"Success and Prosperity to the Institute of Marine Engineers." He said the Institute of Marine Engineers was a very young institution, but during the three or four years of its existence it had attained to a considerable stature and a considerable maturity; and when, some 30 or 40 years hence, it arrived at what might be termed absolute manhood, it would possess an influence and a force of an extraordinary character. In fact, to use an expression belonging to the profession, it would possess an indicated power which no one could possibly imagine or contemplate at the present moment. The objects of the Institute were by no means of a commercial but rather of an intellectual character. Their primary object was to advance the intellectual and the moral status of the profession to which they belonged. Another object was to promote the development of what, for want of a better phrase, he might call a feeling of *esprit de corps*, which was a sentiment of proper pride in the profession with which they were connected. The Institute was also designed to promote a sense of comradeship in their profession, which was a means of rendering them better citizens and better engineers. He noticed from the "Transactions" of the society that a vast proportion of their time was devoted to the discussion of theoretical and practical questions arising out of the sphere of their common practice and observation. How wide that sphere was it was impossible for him to describe, except that it appeared to be co-equal with the use of steam in every shape and form. This great steam power had now been in use in the world for something less than 100 years, but if it was possible for them to be deprived of it to-morrow the world would be thrown back not a hundred but a thousand years—aye, back to the darkest ages of history. But if he regarded the work with which they were concerned in their actual daily avocations in its most modern aspect, he found that the sphere of their professional experience was constantly being enlarged and developed in a most remarkable way. For instance, he need scarcely point out that electricity would lose half its value at the present day if it was not assisted by steam, while that almost secret and swift force which was obtained by the compression of water would be entirely valueless but for the steam engine; and the latest outcome of engineering ingenuity—the dry air engine—would have been absolutely impossible had it not been preceded and endowed by steam power. It was indeed true that steam was the genius of the nineteenth century which endowed the world with riches and blessings that were never dreamed of some years ago. It was the every day duty of marine engineers to deal with this great power in its largest and at the same time in its most varied and complex forms. He ventured to say that the engine-room of one of our great ships was almost a labyrinth of enormous masses of machinery controlled by the most delicate and almost subtle contrivances, and those who knew what was done every day in our mercantile marine never ceased to wonder that for days and weeks and months this ponderous and yet delicate machinery pursued its task in all weathers, under all circumstances, in a tossing ship, when an accident might under some conditions involve the destruction of all on board. There was nothing, he ventured to say, so thoroughly significant of the progress of this great industrial age as the great work that was being done in the propulsion of ships over the ocean at enormous rates of speed, the average distances travelled year by year being almost phenomenal; for it was a common thing now-a-days for a steamer to average from 70,000 to 80,000 nautical miles a year, and this travelling was performed with a safety and an accuracy that were absolutely surprising. And how was this done? It was accomplished owing to the fact that the machinery exhibited a perfect combination of good material and good workmanship, and owing also to the skill and increasing vigilance of those who had to watch and take care of this machinery at sea under all circumstances. If an accident ever did occur they knew they might rely upon the efforts and zeal of the marine engineer to bring the ship safely into port, as was done in the case of the *Umbria*, and in many other instances of a similar kind. If an engineer of the present day was shown the marine engine of which they were proud, and justly proud, 30 or 40 years ago, he would at once recommend that it should be consigned to some Noah's Ark or the South Kensington Museum, so utterly different was it from the machinery now in use. But when the annual dinner of this Institute was being held some 30 or 40 years hence he trusted and believed that the gentleman, whoever he was, who introduced this toast, would have the opportunity of reporting, not only as great and even greater progress than had been attained during the period to which he had been referring, but that the profession of the marine engineer had advanced to the highest rank among the professions of the country.

Mr. James Adamson responded to the toast. He said: Thrice have these walls rung to the echoing strains evoked by this toast, to which I have had the honour of being called upon to respond for as many times, but on no occasion has the importance of it impressed me so much as to-night. It is not that my estimate of the Institute as to its destiny has increased, nor that its powers and functions have been more extended, but that our assembly is so representative in its character while we are favoured by the valued presence of not a few who have stood by us in our struggle for life and position among the institutions of our country—a position now happily recognised. Our muster roll now numbers close upon 700 names, and our financial position is good, inasmuch as the account balances on the right side; but we hope to see it placed in such a condition as to justify us in commencing building operations, so that a hall and lecture-room may be at our command in addition to our present premises. The two points of membership and finance are satisfactory. I do not say that a large increase of numbers always implies an increase of the elements which in the aggregate conduce to the highest good. But I apprehend that an increasing membership justifies me in saying that the Institute is, at least, progressing, and more and more justifying its existence by its extended and extending membership; and I would here take advantage of the opportunity to exhort each and all to assist in its extension both numerically and otherwise. I am so persuaded of the noble work which

can be done by the Institute, and am so—shall I say?—enamoured of it, that were I rich I should endow it with that which would help to add to its usefulness. Being otherwise than rich, I can but give my poor services in my leisure moments as a recreation, and add any enthusiasm I may possess in these depressing times to aid in furthering its interests. It is the privilege of the rich to give of their abundance; it is the privilege of the poor to labour. Whether the privilege to give or to labour is the greater, I am not prepared to say. I can only judge from my experience, and that tells me I have found the privilege to labour a sweet and pleasant duty. I leave it to others to express an opinion on the other point; yet I might say, to a small extent from experience, that the privilege of giving also falls not short of the pleasure of labouring in a good cause. The work of the Institute of Marine Engineers is a good cause, both personally and relatively—personally, in that all who are interested in shipping—and who in this land of ours is not?—derive benefit from its operations; relatively in that the prosperity of our country may be advanced by its work. And who is not patriotic enough to say that we should not keep and preserve our insular pride of supremacy on the seas? In a Bill it was proposed to bring before Parliament but lately I read that certain members of a certain board were to be appointed from amongst those who had no interest, directly or indirectly, in shipping. Methought such would be difficult to find, I would go further, and say I hope it is impossible to find such. Are we Britons? Then it is our bounden dutyto be interested in shipping, directly if we can, but at all events indirectly, and, as a necessary consequence, in all that tends to improve the men and materials in connection with it. The Institute seeks in its own direction to make this the goal of its service to the community and inasmuch as it does so we claim the help and sympathy of all who have an extended horizon before them to grasp the full view presented either landward or seaward from our native shores. Are we proud of our Navy—and by Navy I mean the floating habitations of our merchandise as well as of our defences? If we look at it from the substantive point of view only, we shall fail; let us look at it from another aspect and reverse the question to "Is our Navy proud of us?" What a vista does this open up! From this aspect the Institute of Marine Engineers, I apprehend, views the question, and as with the Institute so with each individual member of it in his own special sphere. The ships and machinery are given to us from the designers and builders to make the best we can of them. It may be hard to do so at times, but our duty lies in keeping them up to the highest pitch of efficiency by care and close supervision, watching closely to effect improvements and economies and prevent waste and loss. If I may so express it, the ships and machinery look to those in charge of them to understand them, their ways and peculiarities, and call mutely to be attended to and kept in such efficient order that all may work harmoniously, econimically, and free from breakdowns, so far as attention and examination can serve to avoid such. The Institute seeks to direct its members thus to hear the call, and while the members have reason, from the position to which it has attained, to be proud of the Institute, the Institute, on the other hand, may reasonably hope to be proud of its members.

Admiral Domville proposed the health of the President, and the toast was honoured with enthusiasm.

Mr. W. H. White, in reply, said that when he was asked to occupy the position of President of this Institute he did so with the greatest pleasure, not because he thought himself worthy to succeed a man like Lord Kelvin, but because he had the highest admiration for, and sympathy with, the work which the Institute was endeavouring to carry on, and he was willing to the best of his ability to help them onward in that work.

Mr. G. W. Manuel, R.N.R., gave the toast of "Kindred Institutions."

Mr. John Inglis, of the Association of Engineers and Shipbuilders in Scotland, and Mr. R. Thompson, president of the North-East Coast Institution of Engineers and Shipbuilders, responded.

Mr. W. H. Northcott proposed "The Visitors," Admiral Bridge replied; "The Honorary Members" was proposed by Mr. Fortescue Flannery.

Mr. Fortescue Flannery, J.P., said that many in the room were old enough to remember the days when no ship was ever built or sent to sea without a figure-head; a figure-head artistically designed and carefully selected, and which was not merely ornamental, but useful in encouraging and heightening the *esprit de corps* of the ship's company. The Institution of Marine Engineers imitated in the fullest way the ancient custom of figure-heads, always selecting its figure-heads in the persons of honorary members amongst the most eminent men in the various walks of life allied to the profession of marine engineers. There was a great work before the Institute, and until the Institution had been formed there was an entire absence of any official body representing the marine engineers of the Mercantile Navy, but now that this Institute had grown so enormously in numbers and influence, there was no doubt that it had already come to be recognised as the official representative of marine engineers. Amongst the important reforms in the interests of the class that the Institute represented would be the bringing together of the engineering branches of the royal and mercantile navies. When it was stated in a public newspaper that one of the highest and best managed lines of mail steamers had to give its engineers notice that they must take the alternative of qualifying and applying for commissions in the Royal Naval Reserve, or resigning their appointment, it was time some steps were made towards removing the objections of entering into the Royal Naval Reserve, which mercantile marine engineers felt, and making such reforms in the Navy as would give the Navy the advantage of the co-operation of the mercantile engineer. This was a work sufficiently important and of sufficient national urgency to be worthy of the attention ere long of the Institute, and in carrying out that work the Institute looked for substantial help from its honorary members, some of whom were already connected with Her Majesty's Navy. Amongst the honorary members they had navigating officers holding high positions among the leading steamship companies, such as Capt. Angove, of the P. & O., Capt. McHirdy, and others. Among underwriters they had some members of Lloyd's who took the greatest interest in the work of the Institute. One of them, Mr. Thomas Aukland, going so thoroughly into the work of the Institute that he had on more than one occasion presided at the meetings for scientific discussions. There were also as honorary members of the association some distinguished naval architects, and amongst them none more distinguished than Mr. Benjamin Martell, the chief surveyor of Lloyd's, with whose name he desired to couple the toast of "Honorary Members." This was not Mr. Martell's first appearance amongst them, he had been at their annual meeting the year before, and he (the speaker) was sure that during the twelve months that had elapsed Mr. Martell's good feeling towards marine engineers had become, if possible, even warmer than it was when he first came amongst them, and he had therefore the greatest pleasure in proposing the toast of "Honorary Members," coupled with the name of Mr. Martell. Mr. B. Martell responded.

The other toasts were "The Country Members," proposed by Mr. M'Farlane Gray, and responded to by Mr. Walker; and "The Press," proposed by Mr. R. Leslie, and acknowledged by the representative of the *Shipping Gazette*.

FELT'S PATENT LUBRICATOR.

THE easy running and reliability of marine engines under continued stress depends almost entirely upon the attention paid to lubrication, but at the same time where excess of lubrication is used to ensure the moisture of all bearings, the penalty of a very heavy bill for oil has to be paid in the long run. An ideal system of lubrication would, therefore, be one in which an ample supply is obtained with regularity, and in which it is easy for the engineer to watch the supply and to regulate the same, whilst excess is automatically stopped beyond what is necessary for perfect lubrication of the bearings.

The carefully worked out system of lubrication which is offered by Messrs. W. O. Felt & Co., of 9, Southampton Street, High Holborn, and which we illustrate herewith, is well worth the attention of owners and engineers, for besides the perfection of an automatic supply of lubricant to the various bearings of a marine engine ensured by this system, the proprietors claim a saving in lubricant, where their

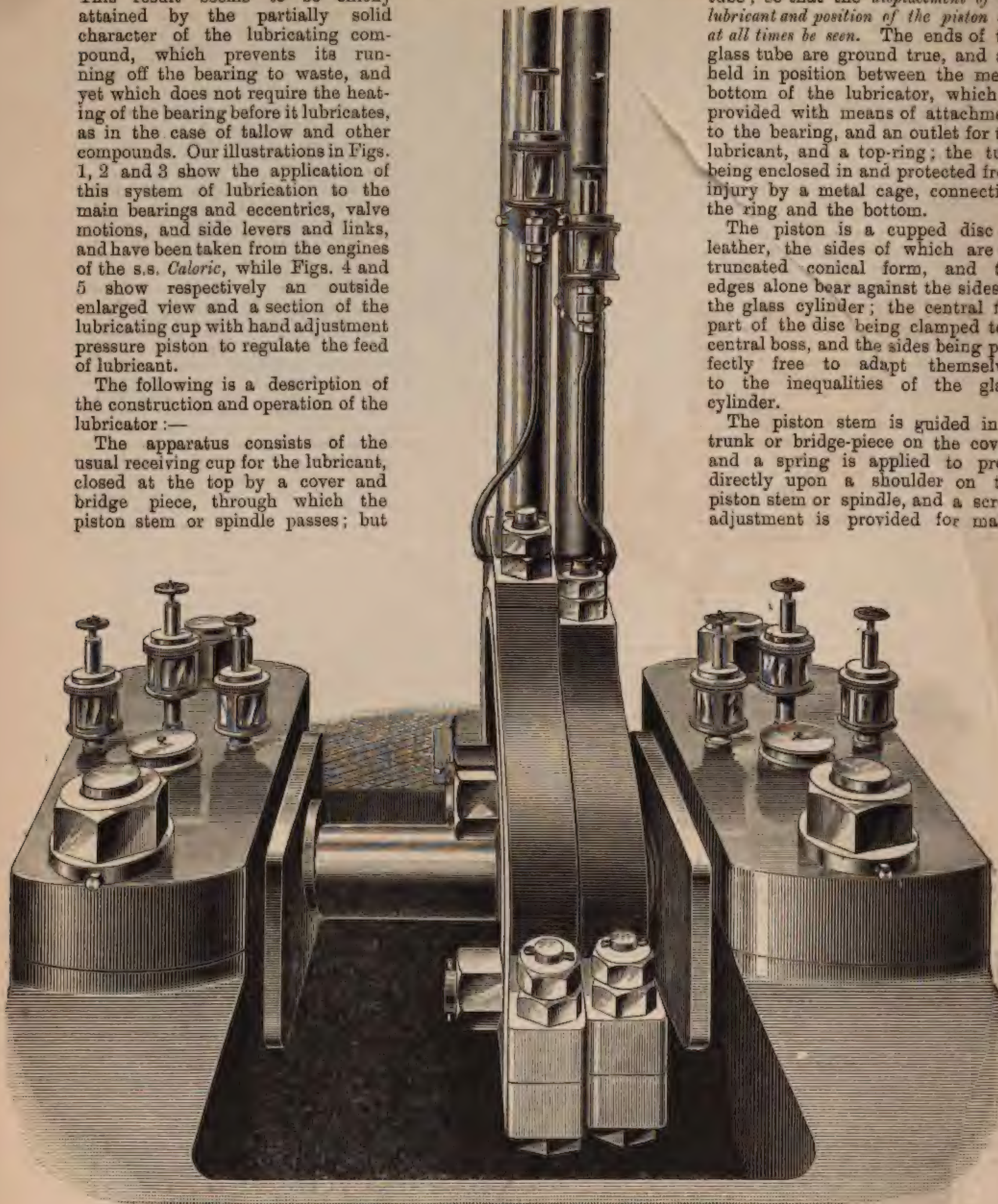
own Lubricating Compound is used, of 75 per cent. as compared with the ordinary method of lubrication. This result seems to be chiefly attained by the partially solid character of the lubricating compound, which prevents its running off the bearing to waste, and yet which does not require the heating of the bearing before it lubricates, as in the case of tallow and other compounds. Our illustrations in Figs. 1, 2 and 3 show the application of this system of lubrication to the main bearings and eccentrics, valve motions, and side levers and links, and have been taken from the engines of the s.s. *Caloric*, while Figs. 4 and 5 show respectively an outside enlarged view and a section of the lubricating cup with hand adjustment pressure piston to regulate the feed of lubricant.

The following is a description of the construction and operation of the lubricator:—

The apparatus consists of the usual receiving cup for the lubricant, closed at the top by a cover and bridge piece, through which the piston stem or spindle passes; but instead of being entirely of metal the sides or cylindrical portion of the vessel is formed of a glass tube; so that the *displacement of the lubricant and position of the piston can at all times be seen.* The ends of the glass tube are ground true, and are held in position between the metal bottom of the lubricator, which is provided with means of attachment to the bearing, and an outlet for the lubricant, and a top-ring; the tube being enclosed in and protected from injury by a metal cage, connecting the ring and the bottom.

The piston is a cupped disc of leather, the sides of which are of truncated conical form, and the edges alone bear against the sides of the glass cylinder; the central flat part of the disc being clamped to a central boss, and the sides being perfectly free to adapt themselves to the inequalities of the glass cylinder.

The piston stem is guided in a trunk or bridge-piece on the cover, and a spring is applied to press directly upon a shoulder on the piston stem or spindle, and a screw adjustment is provided for main-



Application of Felt's Patent Lubricator. Fig. 1. (See page 149.)

taining the pressure of the spring as the piston descends.

For this purpose the central boss of the piston is preferably threaded to receive the threaded part of the stem, by turning which the spring is compressed, the piston being prevented from turning by frictional contact with the sides of the cylinder.

The object of the invention is to keep up as uniform a pressure as possible on the lubricant, so as to maintain a regular and continuous supply to the part to be lubricated.

This object is attained by means of a cupped piston, formed of leather, in combination with a spring and adjusting screw.

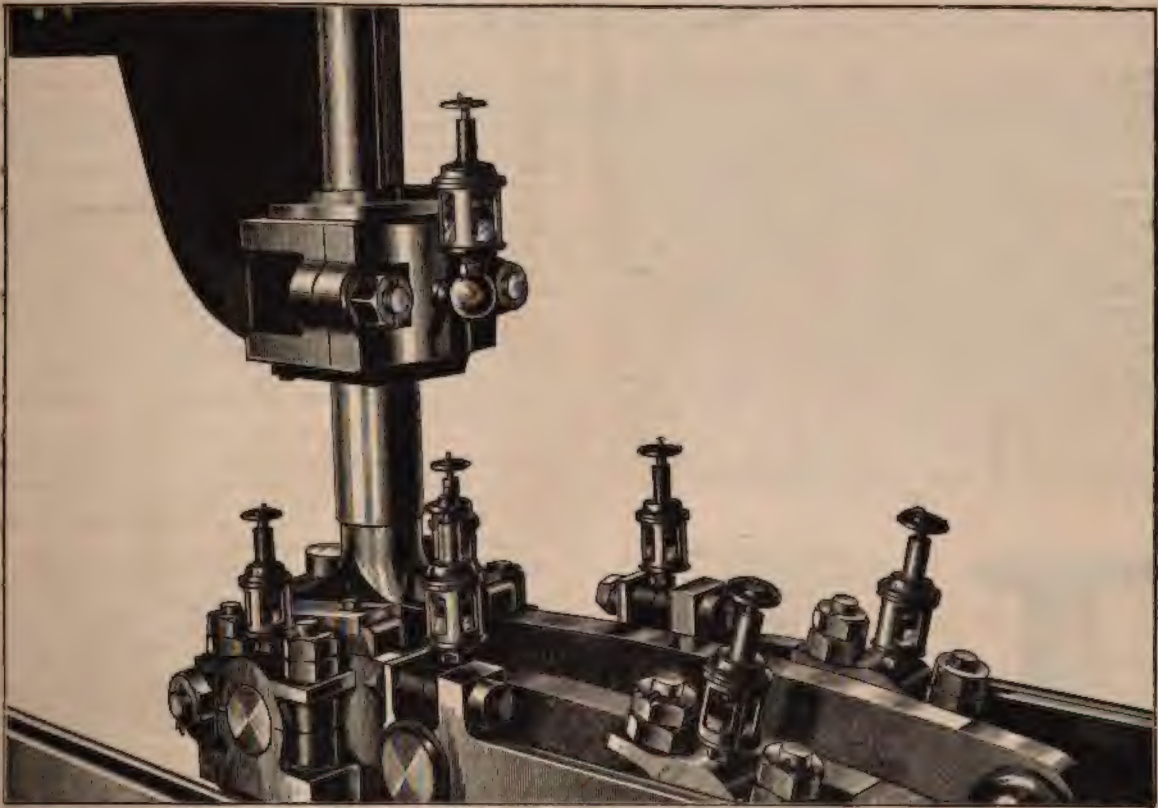
The cupped piston works in a metallic, or preferably, glass cylinder, and is of such a nature as readily

in friction between the centre screw and the friction exerted by the piston against the inner walls of the glass tube.

The recoil of the spring gives continuous pressure of the piston on the lubricant until the regulating wheel reaches the top of the bridge-piece, then the action of the spring ceases. The regulating wheel is again turned to recompress the spring. This may be continued until the piston reaches the bottom of the cup.

The distance of the spindle above the bridge-piece indicates the compression of the spring, and consequent pressure of the piston upon the lubricant.

The gradual return of the spindle, caused by the recoil of the spring indicates the rapidity with which the lubricant is being fed out of the cup.



Felt's Patent Lubricator. Fig. 2. (*See page* 149.)

to adapt itself to any inequalities of internal diameter, such as are almost inevitable when glass is used, and to maintain at all times a tight point against the sides of the cylinder. The spring with adjusting screw ensures a uniform pressure on the lubricant, irrespective of the quantity of lubricant in the cylinder. The adjusting screw or spindle serves as a means of moving the piston up or down in the cylinder as required, and particularly as a means of compressing, and holding compressed, the spring, when the cylinder is filled with lubricant, and of adjusting the piston and recompressing the spring as the lubricant is consumed.

The spindle is turned in the direction that forces the piston down upon the lubricant until the spring is compressed to the required tension. The piston itself, being prevented from turning by the difference

The lubricating compound used by Messrs. Felt & Co. is a combination of the best hydro-carbon oils, in association with a solidifying agent, and is practicably unaltered in consistency upon exposure to either cold or heat within the wide range of temperature extending from many degrees below the freezing point to almost the boiling point of water.

It is claimed to be perfectly free from acid and alkali, and has no action upon the metals employed for the bearings of machinery.

It is not liable to oxydation, and there is no danger of its spontaneous ignition.

It does not run off the bearings, neither does it require them to become heated by friction before it lubricates, like tallow and other compounds.

THE FLEETS OF THE MAIL LINES.

THE P. & O. Co. announce the fact that they have ordered two large steamers to be constructed. These are to be named *Caledonia* and *Japan*. The latter is to be a cargo boat of a type very similar to those recently constructed by the company for similar purposes. The *Caledonia* on the other hand, is to be a mail steamer superior in size and speed even to the lately built *Australia* and *Himalaya*. It seems a striking fact that the building of these vessels, following so closely on that of their recent predecessors, does not mean an extension of the fleet. Merely to keep their fleet up and to replace old and worn-out tonnage, this company has every year to build from 10,000 to 12,000 tons of shipping. In his very interesting speech at the company's half-yearly meeting, the chairman remarked that since 1887 they had added mail steamers of the *Caledonia* class to the value of about £2,000,000 sterling to their fleet. These vessels include apparently the four "Jubilee" boats, *Arcadia*, *Victoria*, *Britannia*, and *Oceana*, as well as the *Australia* and *Himalaya* and now the *Caledonia*. The average cost of these seven vessels cannot therefore fall far short of £300,000 each, and their aggregate tonnage reaches nearly 50,000 tons. Sir Thomas Sutherland raised an interesting point for the consideration of his shareholders, as to whether these great and expensive mail steamers pay in comparision with the cheaper and more economically worked cargo boats. We fear that before we could profitably join in the discussion we should have to ask the directors for data regarding the average mail and passenger receipts which, in these days of close competition, they would probably be very loth to give.

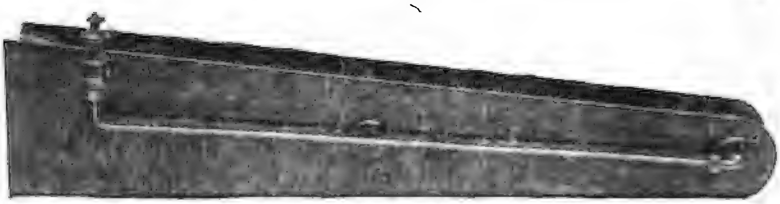


FIG. 3
FELT'S PATENT LUBRICATOR.

FIG. 4.

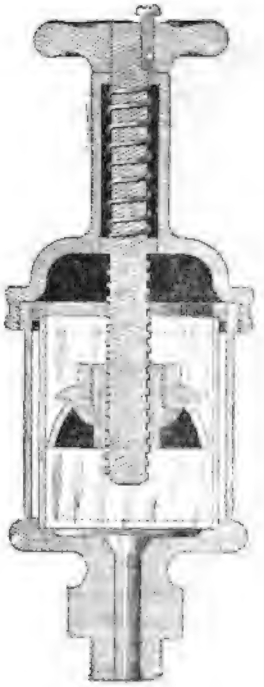


FIG. 5.

FELT'S PATENT LUBRICATOR.

The Guion fleet now consists of four vessels only—the *Alaska*, *Arizona*, *Nevada*, and *Wyoming*. The *Wisconsin*, which was offered for sale by auction on the 18th May and withdrawn, having since been disposed of privately to a Birmingham firm for breaking up purposes. She was an iron screw steamer of 3,700 tons gross and 3,386 tons nett, built at Jarrow, by Messrs. Palmers, in 1870. Her deadweight capacity was 3,000 tons, and she had accommodation for 70 first, 110 intermediate, and several hundred steerage passengers. She was fitted with compound engines and had comparatively recently had refrigerating chambers of a capacity to carry 2,500 quarters of beef put on board. Her fate shows the very slight value of old compound boats, a value that will be even further reduced as time goes on. At present her sister, the *Wyoming*, is lying at Liverpool as a reserve boat, and the service is being maintained by her three companions.

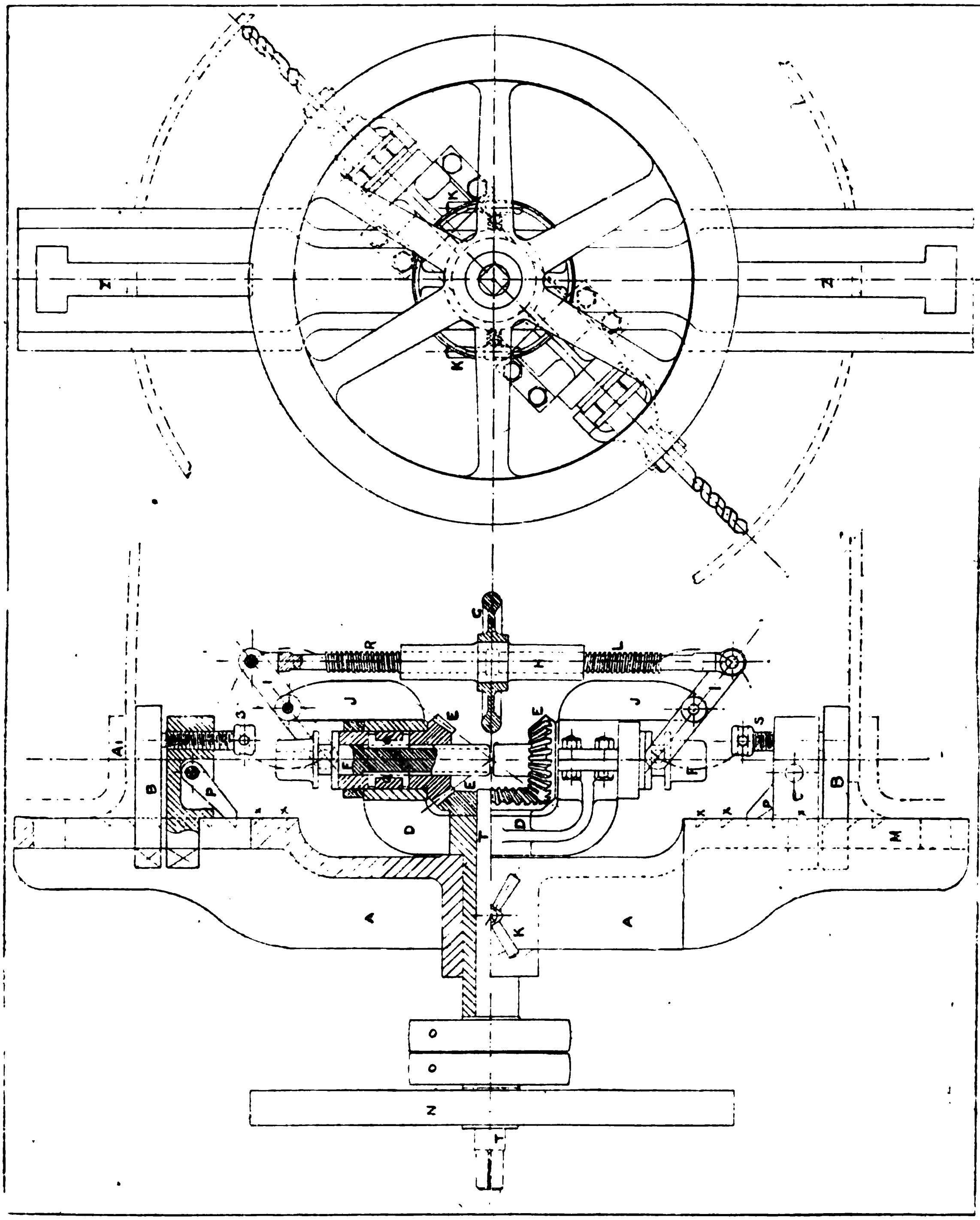
The Cape mail lines have been unfortunate recently, not only in bad trade, but also in casualties. The *Conway Castle* struck on the reefs near Mahanoro on the 10th May, and will prove a total loss, though a great portion of her cargo is recoverable. Then the Union Co.'s *Durban* went ashore at Teneriffe on the 11th June, on her homeward voyage, and she too is unlikely to be refloated. Meanwhile the Union Co.'s three new twin-screw cargo boats, built by Harland & Wolff, are coming on, the *Gaul* having already got to Capetown on her maiden trip, and having made a very fair passage. The second vessel is about to follow her.

La Plata, recently sold by the West Indian Royal Mail Co. to a yachting company, was about to leave Southampton on the 10th June, with 70 passengers on board for a Norwegian cruise, when she was detained by order of the Board of Trade on the ground that the boilers were in an unsatisfactory condition. The passengers were disembarked.

A pleasanter note may be made on the subject of the *Islam*—a great twin-screw cargo boat built last year by Harland & Wolff, for Messrs. Edwards Bates & Co., of Liverpool. She left Cardiff on her maiden voyage in December and a few days afterwards stranded near Cape Trafalgar. She lay in a very bad position and was greatly exposed. Even when she first went ashore there seemed little chance of getting her off, and as the months rolled by even those who know the excellence of the work put into their vessels by the Queen's Island builders must have felt doubtful as to the result. Yet the *Islam* has survived the winter storms, and on the 18th June was got off and towed into Cadiz. This is a very marvellous fact, creditable alike to builders and salvors.

A report is circulated that the North German Lloyd Co. has ordered two vessels from the well-known shipbuilders, Messrs. Harland & Wolff, of Belfast, to compete with the new Cunarders and American Line steamers. The paragraph has the weight of our usually well-informed contemporary the *Daily Graphic*, but there are certain points about it that strike us as a little strange. In the first place the Belfast firm has never yet built a fast Atlantic liner for any line but the White Star Line, with whose progress it has been peculiarly identified. Yet we can understand that for a line such as the North German Lloyd this difficulty might be got over. But another difficulty, and one of a more serious kind, is that of the reported dimensions of the projected vessels. It is said they are to be 450 ft. long, the length of the *Britannic*, and *Arizona*. The *Alaska*, *Oregon*, *Umbria*, and *Furst Bismarck* were all about 500 ft. in length, whilst the *Paris* runs to 527 ft., the *Teutonic* to 565 ft., and the *Campania* to about 600 ft. We can hardly believe that any vessel of a length of only two-thirds her own would venture to dispute the record with the Cunarder. If anything seems certain in shipbuilding it is the proposition that great length is necessary to enable steamers to maintain any approach to their

best performances when they encounter the weather which is the rule rather than the exception on the North Atlantic. For these reasons we think either the vessels are intended for some less heroic purpose than disputing the "record" or it will be found that they are of greater dimensions than suggested.



HUNTER'S FURNACE MOUTH DUPLEX DRILLING MACHINE (See page 154.)

Even patriotism cannot keep the Yankee reporter from finding out secrets and publishing them to the world. Although it is well known that for obvious reasons the shipbuilder desires to keep his plans from his rivals, the details of the new American liners are leaking out. It is said that the designs are by Mr. Biles, who was in the employment of Messrs. J. & G. Thompson at the time when they built the *City of Paris* and the *City of New York*. This gentleman has since had sole control of a shipyard, at Southampton, and this has since his reign passed, we believe, into the hands of the well-known firm of Messrs. Maudslay, Sons & Field. From his designs Messrs. Cramp, of Philadelphia, are constructing two sister ships of 12,000 tons displacement, a size approximating to that of the *Umbria*. Each is to have twin-screws (three-bladed). The steam pressure is to be 210 lbs., which is 30 lbs. over anything at present at

work on the North Atlantic, though the West India & Pacific Steamship Co. has more than one vessel with a pressure of 200 lbs. To get full value out of this high pressure the engines are to be of the quadruple-expansion type, with cylinders 36 in., 50 in., 71 in., and 100 in. diameter, and 60 in. stroke. The steam will be supplied by six double-ended boilers 20 ft. long, and 15 ft. 7½ in. in diameter. These will have 48 furnaces on Purves' principle, 39 in. in diameter, with 820 square feet grate area, and 30,000 square feet heating surface. The speed is not to exceed 20 knots on trial, with an estimated I.H.P. of 5,000. If these details are correct, the new ships will not rival the *Campania*, but will be about the class of ship (as regards size and speed, of course) as the old *Umbria*. The ten years which will have elapsed will have enabled similar results to be attained more economically, but that will be all.

HUNTER'S FURNACE MOUTH DUPLEX DRILLING MACHINE.

IN these days when exactitude combined with expedition of workmanship is the leading feature of our workshops, any tool which claims to assist in obtaining this end is worthy of consideration. The subject of our illustrations is a duplex drilling machine, specially designed for drilling the rivet-holes in the furnace mouth of any boiler, and a good idea of this machine can be got from the illustrations, though the following brief description will assist. The bracket A is fixed to the end of boiler furnace mouth A^1 by an arrangement of loose-plates working in slot-holes ZZ in the bracket. The outer plates BB are checked on the face to make them grip, when pressed by screws S fixed in the inner plate, which shifts out and in and is held in position by the pall P. On the bracket A is the swivel bracket D, which carries on it bevel pinions EEE and drill spindles FF. Hand-wheel G regulates the bore by means of right and left-handed screws R and L working levers II. Screws KK retain bracket D in position when it has been shifted out or in or round about the furnace mouth to suit the pitch of rivet holes. There are graduations at MM on bracket A for the easy and speedy adjustment of the tool to the furnace centre. Taken all over the tool should be a very serviceable one for accurate work, and it can be driven either by belting on the pulleys OO, or direct by an ordinary horizontal or vertical drilling machine. A flywheel and handle also may be fitted for driving by hand-power, but the best method undoubtedly is to employ the power of a drilling machine.

The tool is the invention of Mr. Jas. Hunter, foreman with Messrs. Hawthorns & Co., Leith, from whom full particulars may be obtained on application.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our own Correspondent.*)

The Naval Mobilisation.

THE mobilisation of the greater number of the ships in the reserves at the home ports is now close at hand, and will probably be on a larger scale than on several previous occasions. In the first place there will be the ships of the Channel ...dron—3 battleships:—*Royal Sovereign*, *Anson* and *Rodney*; ...lass cruisers, *Hawke* and *Immortalite*; and 2 small ...*lona*, and *Speedwell*. To these the Coastguard Squadron ...added, consisting of 4 battleships, *Alexandra*, *Neptune*, *Superb* and *Audacious*; 3 first-class cruisers, *Aurora*, *Australia* and *Galatea*; and 2 second-class cruisers, the *Mersey* and *Melampus*. The Portguard ships add 5 more battleships, the *Swiftsure*, *Nelson*, *Triumph*, *Thunderer* and *Bellerophon*. These give a total of 12 battleships, 5 first-class cruisers, 3 smaller cruisers and 1 gunboat. Thirty-four vessels besides torpedo boats will be specially commissioned. There are 3 battleships, the *Benbow*, *Conqueror* and *Hero*; 1 first-class cruiser, the *Blenheim*; 20 second-class cruisers, the *Thames*, *Forth*, *Iris*, *Spartan*, *Indefatigable*, *Æolus*, *Retribution*, *Rainbow*, *Brilliant*, *Intrepid*, *Iphigenia*, *Scylla*, *Sappho*, *Tribune*, *Terpsichore*, *Andromache*, *Naiad*, *Apollo*, *Latona*, and *Thetis*; 2 third-class cruisers, *Pearl* and *Barracouta*, and 8 gunboats, the *Skipjack*, *Salamander*, *Sheldrake*, *Circe*, *Jason*, *Jaseur*, *Gleaner* and *Gossamer*. Thus the combined squadrons will contain no less than fifty-five vessels, of which 13 are battleships, 6 first-class cruisers, 22 second-class cruisers, 3 third-class cruisers, and 9 gun-boats.

The Naval Manœuvres.

After the mobilisation, the manœuvres, and although the plan of these is seldom issued to the public until a few days before they begin, it is not impossible to foretell their probable scope from the composition of the fleet. This year it has been reported very widely that the programme will have something to do with the protection of commerce, and the insuring of safe passage for the country's food supply. This is a very safe guess because indirectly or directly every set of manœuvres since 1885 have had more or less a bearing upon these questions. But most likely the public accepts the announcement as meaning that there is to be more chasing of merchant steamers and the like. Those who think so will be disappointed, for most assuredly battleships and torpedo boats would not have been scheduled in the numbers they are if the plan of action merely comprised commerce protection in its narrow sense. The feature of the manœuvres is the unusually large number of cruisers, there being more than 30 in the two fleets, and this fact points to such a programme as will throw light upon the work of scouting, the number of vessels required for the purpose, and the method of best using them. Such a programme moreover would afford varied tests of the machinery of the many new vessels engaged in the operations.

Launch of Second-class Cruisers.

Two cruisers of precisely the same type were put into the water on June 15th, the one at Portsmouth, and the other at Sheerness. The *Fox*, which was launched at the first-named port, was laid down on January 11th, 1892, and in her case the christening ceremony was performed by the Countess of Clanwilliam. The other cruiser was named the *Charybdis* by Mrs. Powlett, wife of the Captain-superintendent of Sheerness Yard, where she was laid down on September 18th, 1891. These two vessels are among the 29 second-class cruisers that were ordered under the Naval Defence Act, but they also belong to the group of eight modified and improved ships known as the *Astræa* class. They measure 320 ft. between perpendiculars, 49 ft. 6 in. beam, and a maximum load draught of 20 ft. when the displacement is 4,360 tons. The hull is of steel, with sternpost, rudder-frame and sternpiece of phosphor bronze. The engines, of triple-expansion type, are, in the case of the *Fox*, built in Portsmouth Dockyard, and in that of the *Charybdis* by Messrs. Earle's Shipbuilding and Engineering Co., of Hull. They are designed to develop 9,000 and 7,000 I.H.P., with or without forced draught in the stokeholds, respectively, and to attain a maximum speed of 19½ and 18¼ knots per hour. The armaments of these vessels is the same, and comprises on the upper deck two 6-in., eight 4 ft. 7 in., four 6-pounders, and one 3-pounder, all quick-firers; on the main deck, four 6-pounder quick-firers; and on the shelter-deck, four 45-in. machine guns. Twelve torpedo tubes are also carried. The complement of each ship is 300 men and officers, and the total cost £245,550.

Devonport and Keyham.

At these yards the progress of new work has been fairly satisfactory, although there is one lame duck of a second-class cruiser which lags behind terribly. The *Antelope* also, one of the torpedo gun vessels of the *Gossamer* type, has been very long in hand. She was originally laid down in October, 1889, but for a long time work was suspended in her owing to the defects which revealed themselves in the similar vessels under trial. The *Antelope* is to be engined by Messrs. Yarrow, of Poplar, but it is stated that

they refuse to hold themselves responsible for the success of the trials; the boilers are already in the vessel. She was to have been launched in June, but will not now take the water until July 24th. During June the cruisers *Æolus* and *Retribution* were added to the Fleet Reserve, and are ready for the mobilisation if needed. It was anticipated that the new coaling arrangements at Keyham would be proceeded with, but the Civil Lord of the Admiralty has explained that the plans are yet in abeyance pending the consideration of the new extension scheme. The launch of the *Halcyon*, another gunboat, at this port, has been postponed, the construction of the vessel being insufficiently advanced. This vessel will be engined by Messrs. Hawthorne, Leslie & Co. The paying off of the *Warspite* and *Undaunted* has given two other vessels for repairs, so that there is no dearth of work of any kind. The vessels building in addition to those already mentioned, are the gunboats *Harrier* and *Hussar* and the *Hermione* cruiser, while other vessels in hand are the *Northumberland*, *Sybille*, *Bonaventure* and *Astrea*. I must not omit to chronicle the change which has taken place in the naval command here, Admiral of the Fleet the Duke of Edinburgh having been succeeded by Admiral Sir Algernon Lyons; almost the last official act of H.R.H. was to inspect the *Retribution* prior to her leaving the Dockyard Reserve.

Ships paid off or Commissioned.

The *Hawke* (584) and *Arethusa* (309), commissioned at Chatham in May, have joined their squadrons; the former having been attached to the Channel, and the latter to the Mediterranean. The *Hood* (692), recently completed at a cost of £940,000, hoisted the pennant at Chatham, June 1st. She has made her commissioned trial, and left for the Mediterranean to relieve the *Colossus*, already on her way home. The *Australia* having returned from New York, where she attended the review, paid off at Portsmouth, June 7th, and is being prepared to relieve the *Invincible* at Southampton, in place of the *Undaunted*, which vessel needs more repair. The *Undaunted* has returned home from the Mediterranean, and Lord Charles Beresford has hauled down his pennant. The *Warspite*, late flagship in the Pacific, has also arrived home and paid off, having been relieved by the *Royal Arthur*. The *Amphion* is ordered home from the Mediterranean to pay off, although she has been less than eighteen months in commission. This is the vessel in which there has been some trouble with the stokers. It is expected that the crews of the *Anson* and *Rodney*, of the Channel Squadron, will be transferred to the *Empress of India* and *Ramillies* shortly, but no official notification to this effect has been made. The *Hecla's* crew has turned over to the *Vulcan*, and the *Grafton* is to be ready to hoist the pennant in August next.

Sheerness Dockyard.

The chief event at this yard has been the launching of the *Charybdis*, the largest vessel ever built here. The yardsmen are naturally very proud of their handiwork, both in this ship and in her predecessor on the stocks, the *Brilliant*. The other vessel building here is the *Hebe*, gunboat, but owing to delay in the delivery of her machinery, which is being built in the yard, she will not be ready until next year. There are seven more gunboats of this type at this port, and five of them have completed their trials—the *Circe*, *Jason*, *Jaseur*, *Niger* and *Onyx*. The others are the *Leda* and *Alarm*. The *Onyx*, built and engined at Laird's, arrived from Birkenhead on June 3rd. The *Circe*, engined by Messrs. Penn, has been passed into the Reserve, and transferred to Chatham. Messrs. Earle have delivered the engines and boilers for the *Charybdis*, and as soon as they have been put into the ship, she will steam to Chatham to be docked, as there is no dock here large enough for her. The *Landrail*, which has arrived from the Mediterranean, having been relieved by the *Barham*, will, on paying off, be fitted as a gunnery tender at Sheerness, in the same manner that her sister, the *Curlew*, is employed at Devonport.

Return of the "Howe."

The *Howe* is home again safe at Chatham, and if the work is expedited should not be unfit for duty very many months. Not the slightest trouble was experienced in bringing her home. She crossed the bay at easy speed escorted by the *Anson* and *Bellerophon* and *Seahorse*. But nothing went wrong. Up to the time of undocking her, men were at work new plating her continuously day and night at three turns of eight hours each. Amidships they gave her over a skeleton framing fixed in the larger holes, an almost entirely new bottom bolted upon the old one. Forward on the portside is a patch of composite sheathing some 20 ft. by 6 ft., and there is a similar patch on the other side, but further aft. A new keel plate was also fastened over the old one. Altogether the cost is estimated to be about £150,000. A more successful, or more satisfactory feat of engineering than the saving and bringing home of this battleship could scarcely take place.

Portsmouth Dockyard.

Although many hands are employed upon the *Centurion* it cannot be said that her construction is being pushed, and it will be some time before she is ready for trials. The work on other ships here is progressing, and this is especially the case with the repair of the *Sultan*. The whole of the internal woodwork has been taken out possibly for fear that it might in its deteriorated state breed sickness. The rehabilitation of the iron frame has made such strides that if it was desired, the ship might be ready in a few months. There are not, however, any signs of attempting to complete her this year. The *Crescent* is prepared for commission, but she is not in the list for mobilisation; the *Gibraltar*, which has made her trials, is to be ready on July 15th. The *Ramillies* is also nearly complete. The *Achilles* has come back with the *Trafalgar's* crew, and paid off, and her captain has been reappointed so that the rumour that she is to take out another crew is probably unfounded. The refit of the *Devastation* progresses, but it is not meant that she shall replace the *Nelson* for another couple of months. They are glad here to see the *Vulcan* hoist the pennant of Captain Durnford, for she has been an eyesore in the yard for so long. Everyone will look forward with interest to see how she acquits herself during the manœuvring. Tenders for excavating and building two new docks here have been received, but no contracts have yet been made, in any case only sufficient money was voted to make a beginning.

Examination for Engineer Students.

The following is a list of the successful candidates in order of merit who obtained the first twenty-nine places in an open competition examination held on the 18th April, 1893, for engineer students in the Navy:—P. L. Edmonds, London, 1,501; J. C. Baker, London, 1,453; E. B. Hunton, Newcastle, 1,452; W. H. Micheli, London, 1,419; A. W. McKinlay, Portsmouth, 1,323; S. G. Misselbrook, Portsmouth, 1,293; H. L. Battersby, Liverpool, 1,287; T. G. Coomber, Portsmouth, 1,284; R. S. Pearce, Portsmouth, 1,282; E. E. Bantlett, London, 1,268; C. H. Dawe, Portsmouth, 1,260; N. C. Woodfin, Bristol, 1,254; S. B. Williams, Liverpool, 1,252; C. H. Rew, London, 1,236; G. R. D. Martin. 1,233; J. C. M. Boyle, Devonport, 1,231; H. E. Wolfe, Portsmouth, 1,224; G. W. Woodhouse, Liverpool, 1,215; A. Rowe, London, 1,215; B. W. G. Cook, Portsmouth, 1,211; F. F. May, Portsmouth, 1,197; F. W. Turner, London, 1,188; M. G. Winder. London, 1,185; H. M. Attwool, Portsmouth, 1,142; J. H. C. Hearn, Devonport, 1,125; J. E. Hanson, Leeds, 1,116; A. L. Picton, Liverpool; 1,110; T. E. F. Lilburn, Devonport, 1,103, and L. M. Hobbs, London, 1,095.

Pembroke Dock.

There has not been much to chronicle at this yard during the past month. Orders have been received to make the frame moulds for the *Howe* because she was built here, but there is not space in the dock for her, so the moulds will be sent to Chatham. The gunboat *Hazard* will be the first vessel here ready for launching, but no date is yet fixed. The cruisers *Cambrian* and *Flora*, are also in hand, and the battleship *Renown* is growing but slowly. A new port guard-ship in the shape of the *Rupert*, from Portsmouth is to come here to relieve the *Bellerophon*. The *Rupert* has been re-armed and re-engined, making on trial a speed of 14 knots, so that although she is not so stately looking as her predecessor, probably she will be more efficient.

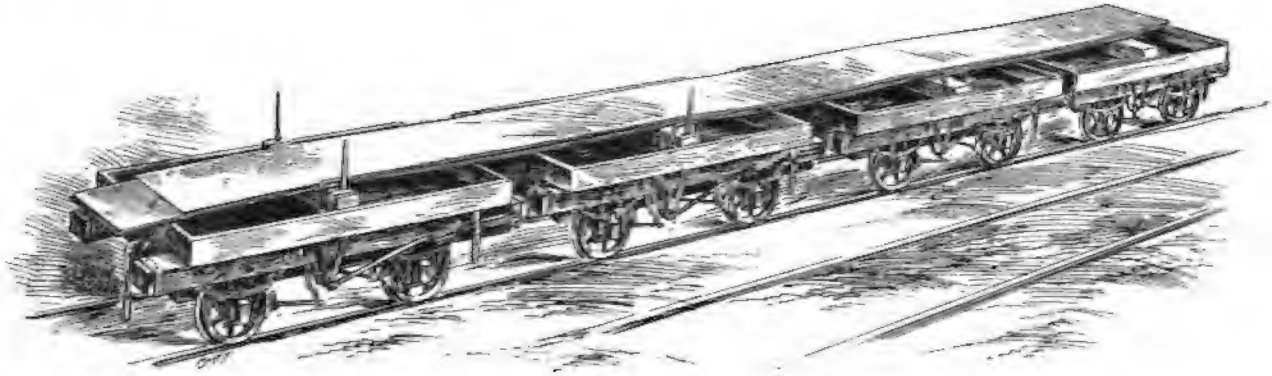
Battleship and Cruiser Trials.

The *Empress of India* having passed through all her steam trials most successfully, and the report upon the opening up of engines and boilers being favourable, the machinery has been accepted from Messrs. Humphreys, Tennant & Co. The *Crescent's* contract trial was also successful, the engines developed 10·370 I.H.P. with natural draught, and a speed of 18·6 knots was attained. Her engines and boilers on being opened up received

a satisfactory report. The *Grafton*, a sister ship, built and engined by the Thames Ironworks Co., has been sent to Plymouth to undergo a full-speed forced draught trial, when it is hoped that she will develop 12,000 H.P., her sister's having been accepted on the natural draught trial with 10,000 I.H.P. The *Melampus* made a very satisfactory commission trial before relieving the *Belleisle* as coastguard ship at Kingstown.

CHATHAM DOCKYARD.

A number of ships have left this port recently, but they seem to make no diminution in the number in hand. The *Barfleur* is to be fitted as a flagship, and is to be ready for sea early in 1894. The *Agincourt* and *Monarch* are also refitting, and the Admiralty have expressed themselves satisfied at the proposed rate of completion. The *Ajax*, after an extensive overhaul and repair, at a cost of £40,000, is now ready to go to Hong-Kong to take the place of the *Victor Emanuel*, but no date has been fixed. The engines of the *Forte*, now making here, are to be dwarfed as a job by those of the *Minerva*, which have just been ordered; each of the dockyards will build the engines for its own cruiser, and they will be of 9,600 H.P. to give 20 knots speed. The *Forte* is to be ready for launching in September. The *Dryad* will probably be ready sooner, her engines are to be supplied by Messrs. Maudslay & Co. The refit of the *Pylades* is now complete, and most of the ships in the Fleet Reserve are being docked preparatory to the manœuvres.



A FEAT IN SHIPBUILDING.

OUR manufacturers do not stand still in their efforts to produce material tending year by year to improve the strength and reliability of the structures of which they are to form part. An ideal hull would undoubtedly be that in which there are the fewest joints and rivets, both from the points of view of simplicity in making and reliability when made.

Although we have not yet seen a boiler with only a single longitudinal joint, the manfacturers of ships' plates are beating record for lengths of narrow plates.

We illustrate herewith a ship's plate of 60 ft. in length by 4 ft. to 4 ft. 3 in. in breadth, lately turned out for Messrs. Furness, Withy and Co., Limited, of West Hartlepool, by the Consett Iron Co.

The first-named firm are supplying these plates to cattle-boats, that they are building for the Chesapeake and Ohio Steamship Co., of London. These boats are intended for very heavy Atlantic work, and only one "butt" joint in a strake of 120 ft. is needed. We are confronted with a decided novelty indeed in shipbuilding.

We understand this firm have been in the habit of ...g plates 32 ft. in length for some time, and it is ...t that their employés have thereby got accus... to the handling of long sheets, as we are assured that these mammoth plates have been punched and handled with ease, and present a very handsome appearance, and to the satisfaction of Lloyd's surveyors. We wish every success to such an example of enterprise and audacity.

THE SILENT SAFETY STEP.

ALL passengers on board steamers must have often experienced the inconvenience and danger attached to the brass bound steps, usually employed

FIG. 2.

for companionways. There is no doubt that such treads must be protected so as to be durable, and to be easy of renewal when worn; but the difficulty to passengers of keeping their feet in a sea-way is sufficient, without the added danger of slippery brass bindings to the steps.

We illustrate herewith a tread which promises absolute safety to the tread, and has also the great advantage of being silent.

Fig. 1 shows a companionway provided with the safety tread of the Silent Step and Flooring Co., of

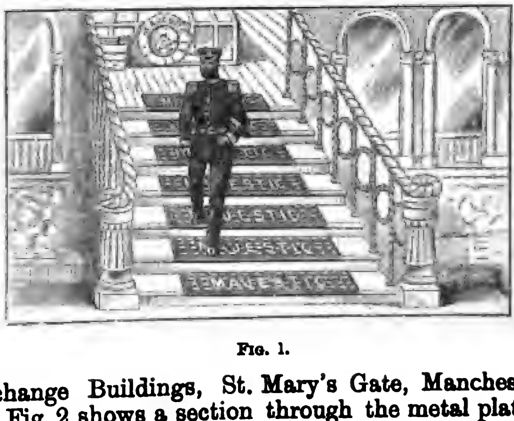


FIG. 1.

Exchange Buildings, St. Mary's Gate, Manchester; and Fig. 2 shows a section through the metal plate of the tread, and a rubber block securely fixed therein. The steps and flooring consist of a metal sheet, which may be steel or iron, galvanized or enamelled to prevent rust, or may be of brass, according to taste, and it is pierced with a number of diamond-shaped

or square holes, into which studs or blocks of the most durable india-rubber are inserted, which give an absolutely firm foothold, and render slipping and noise impossible.

The india-rubber blocks are so dove-tailed into the frames that they cannot come out, and for additional silence and protection the plates are covered at the back by a sheet of rubber and canvas.

We understand the company have already fitted up several large vessels with these treads, in which they are much appreciated by both passengers and owners.

These treads in plates might be very usefully applied also to the parts of decks where it is desired to deaden the sounds of walking to those below, as they can be easily cleaned and will stand any amount of wear.

The name of the ship can be inserted in lieu of studs in the middle of the plate, and in a brighter colour of rubber.

THE NANSEN NORTH POLE EXPEDITION.

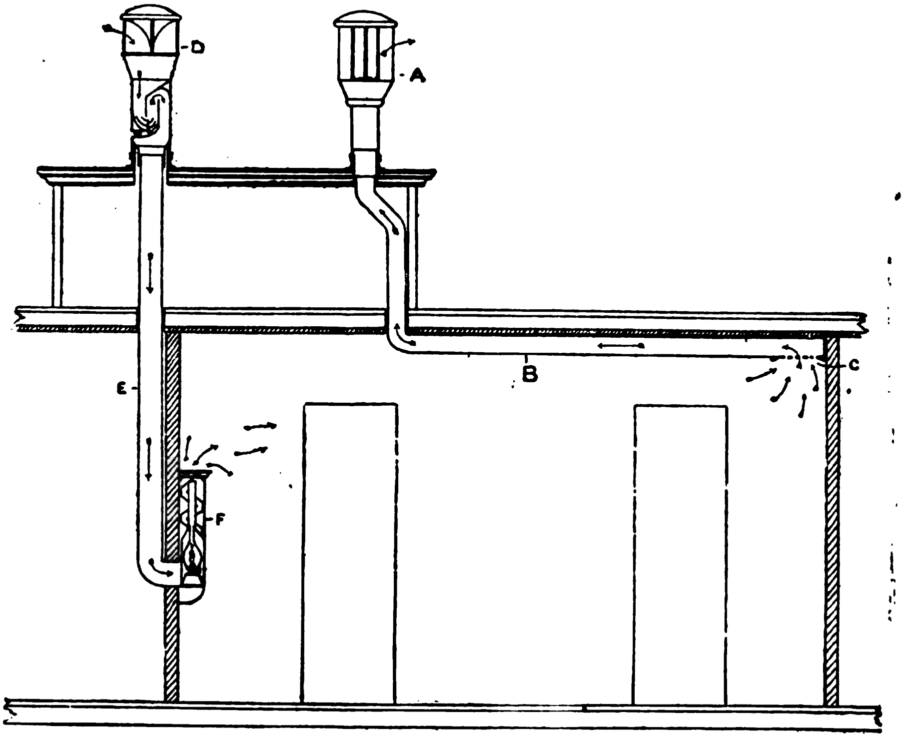
THE accompanying diagram shows a longitudinal section of the saloon of the *Fram*, the vessel which has been specially designed and constructed for Dr. Nansen's North Pole Expedition, which left Christiania on the 24th of last month. The vessel was built at Laurick, Norway, at the works of Mr. Colin Archer, and in form resembles a Scotch buckie boat, but schooner rigged and furnished with engines of about 170 I.H.P., the dimensions being 39·00 metres over all, and the greatest beam 11·00 metres.

According to Dr. Nansen's theory, the vessel will get frozen in somewhere in the neighbourhood of the Liakov Islands and be conveyed by the presumed movement of the ice to and past the North Pole, and be finally discharged by this supposed current into the East Greenland seas.

The crew will consist, all told, of not more than 12 men, and provisions for five years will be carried.

As the ventilation of such a ship is of the highest importance, the Boyle automatic system of ventilation has been adopted, supplied by Messrs. Robert Boyle & Son, Limited, ventilating engineers, of London and Glasgow, and is applied as shown on diagram, the details of which are described as follows :—A, Boyle's latest improved patent self-acting air pump ventilator (exhaust). B, Ventilating exhaust pipe carried to end of saloon. C, Regulator. D, Boyle's patent downcast ventilator. E, Fresh-air supply pipe. F, Fresh-air inlet bracket for the admission of warmed air, fitted with regulating valve, heating coil and oil-lamps, which are also utilized for lighting purposes. This arrangement has been designed by Dr. Nansen and Mr. Robert Boyle to meet the special requirements of the case, and will be employed when the vessel is frozen into the floe ice, which will be for the greater part of each year.

Both the upcast and the downcast ventilators are absolutely weather-proof, and though always in action no water can pass down them into the saloon, into which the cabins are also ventilated. Adjustable hoods are provided to protect the ventilators from snow.



THE BOYLE SYSTEM OF VENTILATION APPLIED TO THE POLAR SHIP FRAM

NANSEN NORTH POLE EXPEDITION

THE GEDDES PULSATOR ECONOMISER.

ALL marine engines are troubled with a considerable accumulation of water, due principally to condensation during expansion, and this is particularly the case in the modern triple expansion engines. It has been proved that an ordinary triple expansion marine engine, indicating 1,000 H.P., from 8 to 10 tons of water per day are discharged from the high pressure cylinder. Even where the accumulation is not of so great an extent as to form an absolute danger in the cylinder, still the presence of water in the cylinder materially decreases the efficiency of the steam, and unless effectively drained off, wastes the fresh water in the boiler, and serves rapidly to destroy the gland packing

Fig. 1.

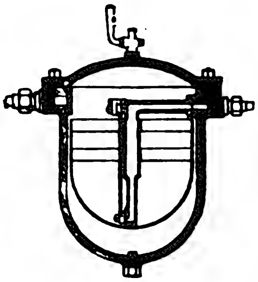
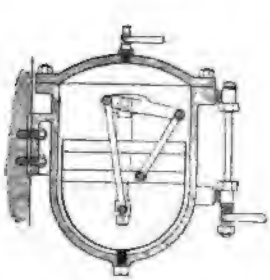


Fig. 2.



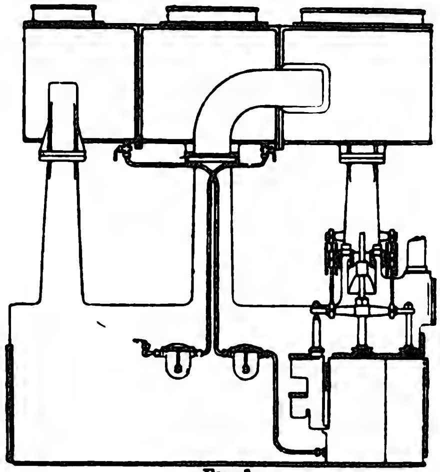


Fig. 3.

To allow of the escape automatically of such accumulated water, and at the same time to prevent the escape of steam, requires an apparatus of some ingenuity, and it is stated that the Geddes Pulsator Economiser, which we illustrate herewith, is one of the most efficient of such automatic escape traps.

As will be seen from the sectional views of the apparatus, in which in Fig. 1 the apparatus is shown closed, and in Fig. 2 open, with the water being ejected, the apparatus consists essentially of an open-mouthed bowl, suspended by a link to a rocking lever, of which the shorter opposite end is attached by another link to a slide valve which opens or closes the exit of the water to a waste-pipe. The travel of the float being considerably more than that of the slide valve, a float of small size and weight is very effective. When the steam is dry, and there is no accumulation of water, the float stands in its highest position, floating on the water in the exterior chamber, the slide valve covering the port. When however water accumulates in the float, the latter sinks, thus opening the port and allowing the water to be discharged until the float once more rises and closes the port.

In Fig. 3 is shown the usual arrangement of two pulsators attached to drain cocks of the high pressure and intermediate cylinders.

All steam pipes of any length are subject to become water-logged with condensed water, such as steam-whistle pipes, steam pipes to steering engines, dynamos, winches, and in all these instances the pulsator will afford excellent service to keep them clear of water. An air cock is fitted on the top of the vessel, and this also affords a means of supplying a little oil to the interior, which, floating on the top of the water, lubricates the various working parts. Any accumulation of dirt in the bottom of the vessel can be blown off by the bottom gauge cock. We understand, in the case of one works, as much as 27 tons of distilled water per day are caught by these pulsators and returned to the boilers.

In addition to the evils arising from condensed water in the cylinders, it is well-known that any excess of oil from the cylinders is very deleterious to the boilers when returned there with the feed water. The pulsators are of great service in this respect, as any oil which may accumulate in the trap can be blown off periodically.

This simple and durable apparatus, the invention of Mr. C. Geddes, of Drury Buildings, Water Street, Liverpool, is manufactured by Messrs. Thos. Richardson & Sons, Hartlepool, who guarantee the efficiency and durability of the pulsator economiser.

OBITUARY.

SAMUEL S. CARRICK.

ON Tuesday evening, June 20th, a large number of sympathising friends met at Euston Station, London, to record their sense of the deep loss sustained by the death of (and to pay their last token of respect to the remains of) the late Samuel S. Carrick, who for the past nine years had served as superintending engineer of the Shaw, Saville, and Albion Steamship Co., and the White Star Line, gaining the respect, esteem, and goodwill of all with whom he came in contact.

Apart from business he was highly esteemed and valued for his social qualities by an extensive circle of friends.

Mr. Carrick was present at the dinner of the Institute of Marine Engineers—of which association he was a valued and well-known member—on the 7th June, and shortly after taking his seat he was seized with a fainting fit, induced possibly by the heat we have been suffering from of late; he was at once removed to King's College Hospital, adjoining Holborn, whence after being treated for a few days, and being considered well enough to justify the change, he was taken home to his relatives, and appeared to be progressing favourably till Saturday evening, the 17th June, when he suddenly slipped away, to the deep grief of his sisters and brother, and the universal regret of all who knew him.

The body on Tuesday evening, after a brief service, conducted by the Rev. M. Elder, of Greenwich, in the house at King Henry's Road, Hampstead, was conveyed to the Euston Station, London, where the hearse, with a multitude of flowers and wreaths, was met by many prominent engineering and other friends of all classes, who followed the coffin to the railway van appointed to convey it to Glasgow, the ultimate resting place being the Necropolis in that city, where also the remains of Mr. Carrick's father are interred.

It is seldom that so spontaneous and numerous an assembly meets together at such an hour for the purpose that called the gathering on Tuesday evening at Euston, to pay respect to the memory of one who was so quietly unostentatious in character. It is a proof that amid the busy hum of life in the great city. there is still much cherished sentiment, and a large amount of feeling left. Long may such continue to prevail among social currents of life, to preserve it from that harshness and hardness which tends to wreck the higher and nobler instincts of humanity.

Edmiston's Filters.—In reply to correspondents, the Glasgow Patents Co., Limited, are the proprietors of the patents; Mr. Edmiston, however, retaining a substantial interest in the business. They manufacture and sell, but have special arrangements with Messrs. Maudslay, Son & Field, of Lambeth, London, for making and supplying to the Admiralty and Foreign Navies, and for English houses.

Sand Pump Dredger.—The dredger *Jupiter*, at Maclean, has broken an Australian dredging record. On Wednesday, April 19, she lifted and discharged 3,000 tons of silt in eight hours, the previous record, of 2,000 tons, which were lifted but not discharged, being held by the dredger *Neptune*. She is now deepening the river channel at Lawrence. After the silt is raised it is again deposited in one of the deep holes in the river. This is generally condemned, because the tide carries the deposit to places that were shallow previously. The sand pump dredger *Jupiter* was built by Wm. Simons & Co., Renfrew.

Clyde-built Steamers for Russia.—The Minister of Marine, at St. Petersburg, who recently decided upon the preliminary arrangements for the despatch of an expedition to the mouth of the Yenissei, under the command of Lieutenant Dobrotvorsky, has, in furtherance of the scheme, sent an order to a well-known shipbuilding firm in Dumbarton for the construction of three vessels, which will be utilised for the transport of rails for the Siberian Railway. Lieutenant Dobrotvorsky has left for Scotland to supervise the building and fitting out of the ships, and in a few weeks he will be joined by the sailors who take part in the expedition. The crews are entirely volunteers. The expedition will start on July 27th, and will be accompanied from England by Captain Wiggins, who has already made a voyage to the mouth of the Yenissei on board the steamer *Labrador*.

The Liverpool Bar.—Whilst Southampton is so busy attacking the trade of Liverpool in one of its most important branches, the Lancashire dock board is really waking up, and things are happening there comparatively quietly which, if they were to take place in the South-Western port, would make the columns of the London press teem with admiration of the energy and capacity of the new dock owners. The new dredger *Brancker* passed a very satisfactory trial in the middle of June, and a week later, on the 22nd, the practical results of what has been already done were shown by the fact that the inward bound White Star boat *Majestic* crossed the bar at 3½ hours ebb. Her draught of water was 23 ft. 6 in. Before these operations were commenced such a vessel arriving at such a time must have waited some six or seven hours. If such results have been achieved by the tentative and half-hearted experiments undertaken by the Mersey Docks and Harbour Board only a couple of years ago, we may feel sure that now that they have seriously put their hands to the work and built themselves the finest dredger in existence, that the days of the Bar are numbered, and that its place will soon know it no more. When Liverpool can be entered "at all states of the tide," its chief weakness will have been made strong. The pity is that the dredging was not done years ago, the value of a graciously accorded concession is much greater than that of one which is wrung forth by competition or necessity.

Around the World in Sixty-two Days.—A couple of letters which have just appeared in the *Times* show a somewhat amusing phase of the healthy rivalry which is maintained between the P. & O. Co. and the Canadian Pacific Line, between the old route and the new, between the east and the west. The stately P. & O., unlike its rival, seldom rushes into print. When the performances of the new "Empress Boats" were showing the world the undoubted advantages of the Canadian route the older line lay low, but the correspondence we refer to shows very clearly that in the art of letter-writing they are quite "up to date." The European agent of the Canadian Pacific first wrote to call attention to the fact that a letter he had posted in England on the 7th April, addressed to Hong Kong *via* Suez, had been re-posted thence, and returning *via* the Pacific and Vancouver had reached him again on the afternoon of the 8th June, after an absence of only sixty-two days. This he rightly considers a very marvellous performance. But the secretary of the P. & O. Co. shows that the outward journey of this missive *via* Suez in the s.s. *Oriental* to Hong Kong was under twenty-four days, leaving a balance of thirty-nine days for the detention at Hong Kong and the journey thence over the Western Continent and the Atlantic. Until we hear the date of the departure from Hong Kong we must hold that the credit of this performance rests with the Suez route. If the Canadian mail brought the letter back in anything approaching the time it went out, it is obvious that when the arrival at and departure from Hong Kong fit properly, the time of transit will be considerably reduced even below the present record.—From the *Journal of Commerce*, 19th June, 1893.

Phosphor Bronze.—The Phosphor Bronze Co., of Southwark, has issued the third edition of its price list. Our readers are aware of the various compositions and alloys manufactured by this company. Not only have we frequently spoken of them in these columns, but it would nowadays be hard indeed to find anyone connected with engineering who had not had personal experience of their qualities. The present issue is unusually interesting, because it marks the development of the aims of the company, and of the uses to which their products can be put. It is not so very long ago that it was considered somewhat of a bold departure on the part of a shipowner when he first ventured to equip his fast mail steamer with phosphor bronze propeller blades. "It was such a serious addition to her cost." The experiment resulted, as we all now know, in complete success. In a steamer costing say, £150,000, an addition of £5,000 (which is a ridiculously high estimate for the extra cost of four phosphor bronze blades) added, a full knot to the speed of a 17-knot boat. The £5,000 would not really be thrown away like other expenditure on a vessel, for old phosphor bronze always fetches something near its original price. Thus an allowance of 10 per cent. per annum for interest, insurance and depreciation is (where depreciation is so low) a very liberal one. Ten per cent. on £5,000 would be only £500 a year, and the difference between 17 and 18 knots for an ocean greyhound is at least £10 a day in the coal bill. As these vessels are at sea at least six months in the year the investment looks like one which will return 200 per cent. But we are not writing a prospectus of a limited company which offers to make a fortune for its shareholders by furnishing greyhounds with improved propellers; we are merely showing that the public has recognized, in regard to propellers, at least, that a wise liberality is the truest economy. The same reasoning leads to developments of these alloys in other directions. The present catalogue contains interesting pictures of two vessels. The first is that of the composite racing yacht *Eva* (formerly *Edis*), which in 1892 gained sixteen first and five second prizes in racing. It was considered worth her owner's while to go to the expense of having her angle irons (the reader will pardon the "appropriate occurrence of a bull") wrought in Bull's metal. Some other parts of her fabric were also of the same material. Her success justified his action. The other illustration to which we refer is that of a torpedo boat (Admiralty pattern, second-class), which has been built entirely of this material, her plates being of Bull's metal. We see then that wherever strength and lightness are absolute requirements, and expense a secondary consideration, it is already practically recognized that these materials can be used for purposes undreamed of a short while ago. We look for a very extended recognition of this fact by consumers within the next few years, and therefore we are pleased that the company has added to the volume the "useful tables" of the weight, strength, &c., of their metals. These contain the result of comparative tests made at Berlin by order of the Minister of Commerce into the comparative resistance of phosphor bronze and ordinary bronze to pulling and twisting strains. The comparative tables of the weight and strength of materials cannot fail to be of use, not only to those who actually are using the metals, but also to those who are considering whether the time has not arrived when they can advantageously take a new compound into their service in exchange for what has hitherto done their work to their satisfaction.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from May 27th, 1893, to June 24th, 1893:—

Anderson, William J., engineer to the *Vulcan*,, to date June 19th.
Andrew, William J., chief engineer to the *Rupert*, undated.
Anstey, Henry C., (supernumerary), probationary assistant engineer to the *Pembroke*, to date July 1st.
Baldwin, George W. (supernumerary), probationary assistant engineer to the *Victory*, to date July 1st.
Baldwin, Henry St. C., engineer to the *Benbow*, to date June 19th.
Barnett, Horatio S. (supernumerary), probationary assistant engineer to the *Pembroke*, to date July 1st.
Barter, Frederick (supernumerary), probationary assistant engineer to the *Vivid*, to date July 1st.
Blakeman, Mark, engineer to the *Latona*, to date June 19th.
Bowing, John (supernumerary), probationary assistant engineer to the *Pembroke*, to date July 1st.
Block, Robert J. (supernumerary), probationary assistant engineer to the *Victory*, to date July 1st.
Carey, John J., engineer to the *Andromache*, to date June 19th.
Cleave, Thomas W. (supernumerary), probationary assistant engineer to the *Vivid*, to date July 1st.
Crabtree, Ernest (supernumerary), probationary assistant engineer to the *Empress of India*, to date May 26th.
Ferguson, Samuel P. (supernumerary), probationary assistant engineer to the *Victory*, to date July 1st.
Firks, W. J., staff engineer, has been placed on the Retired List.
Fraser, George J., fleet engineer to the *Invincible*, to date June 8th.
Gibbs, Alfred W., fleet engineer to the *Vernon*, additional, to date May 26th.
Grant, Arthur B. (supernumerary), assistant engineer to the *Pembroke*, to date July 1st.
Gregg, Charles J. (supernumerary), probationary assistant engineer to the *Pembroke*, to date July 1st.
Green, Donald P., engineer to the *Vulcan*, to date June 19th.
Harding, Robert, chief engineer to the *Crocodile*, additional, to date June 1st.
Hore, Frederick, engineer to the *Osborne*, to date June 22nd.
Houghton, Sidney A., engineer to the *Indefatigable*, to date June 19th.
Huddy, Charles J., engineer to the *Blenheim*, to date June 19th.
Huddy, John B. (supernumerary), assistant engineer to the *Victory*, to date July 1st.
Hughes, Thomas, fleet engineer to the *Australia*, to date June 8th.
Hyde, Thomas H., staff engineer to the *Iron Duke*, to date June 20th.
Kestell, Edwin B. (supernumerary) probationary assistant engineer to the *Vivid*, to date July 1st.
Langton, Charles, engineer to the *Rupert*, undated.
Maltby, Percy D., assistant engineer to the *Vulcan*, to date June 19th.
Markham, Reginald G. (probationary), assistant engineer to the *Ramillies*, to date May 26th.
M'Carthy, John, staff engineer to the *Achilles*, to date June 8th.
M'Laurin, John (supernumerary), assistant engineer to the *Vivid*, to date July 1st.
Mountfield, James (supernumerary), assistant engineer to the *Victory*, to date July 1st.
Moysey, W. H. S., engineer to the *Australia*, to date June 8th.
Norrington, Edward, fleet engineer to the *Undaunted*, to date June 21st.
Nye, Alfred J., chief engineer to the *Vernon*, additional, to date June 1st.
Percey, John J. G. G., engineer to the *Vivid*, for the *Rainbow*, to date June 19th.
Pippett, William H., engineer to the *Iris*, to date June 19th.
Pitt, Cornelius, staff engineer to the *Victory*, for duty on the *Hecla*, to date June 19th.
Read, Alfred T. P., assistant engineer to the *Nile*, to date May 26th.
Rider, Sydney, assistant engineer to the *Vulcan*, to date June 19th.
R[illegible] George, fleet engineer to the *Cordelia*, to date June 19th.
[illegible]nes R., engineer to the *Intrepid*, to date June 8th.
[illegible] Edward J. (supernumerary), probationary assistant [illegible]er to the *Vivid*, to date July 1st.
Rundle, Mark (supernumerary), probationary assistant engineer to the *Vivid*, to date July 1st.
Rundle, Richard T., fleet engineer to the *Vivid*, additional, to date June 1st.
Shattock, Thomas (supernumerary), probationary assistant engineer to the *Victory*, to date July 1st
Smith, Frederick P., engineer to the *Pique*, to date July 5th.
Sutton, Francis J. (supernumerary), probationary assistant engineer to the *Victory*, to date July 1st.
Tregenna, Richard H., fleet engineer to the *Glatton*, to date June 9th.
Waddy, George J., staff engineer to the *Vulcan*, to date June 19th.
Watson, Lewis J. (supernumerary), probationary assistant engineer to the *Pembroke*, to date July 1st.
Whayman, William M. (supernumerary), assistant engineer to the *Vivid*, to date July 1st.
White, Arthur F. (supernumerary), probationary assistant engineer to the *Vivid*, to date July 1st.
White, G., staff engineer, has been advanced to the rank of "Fleet Engineer" in Her Majesty's fleet.
White, William, chief engineer to the *Active*, to date June 1st.
Yeats, Henry T., engineer to the *Landrail*, to date June 29th.

HOAR & BROWN'S HARDWOOD MARKET REPORT, JUNE 22nd, 1893.

Teak.—Notwithstanding the poor display at the first forced sale, the market has received yet another trial, which resulted still more disastrously, and will no doubt check any further movement in that direction for the present. The stocks are slightly decreasing, and if the small holders will only let things take their course, instead of running prices and causing general havoc, they will soon be satisfied with the result.

Taking into account the bad state of trade in general, there has not been by any means a scanty amount of business done with fresh timber, and should shipments cease for awhile a firmer market would soon be seen.

Planks are still very low in value, and it is with difficulty purchasers are found to lighten the present heavy stocks.

Mahogany.—Very little anxiety is being shown among dealers to secure ordinary parcels, the only run being upon 24 in. and upwards, which is still commanding full prices. Spanish maintains its value especially for anything roey, and some large business has lately been done. This market at present is holding some very superior figured logs which should sell to advantage. Cuba is still, more or less, at a standstill, very few inquiries being about for ordinary logs. Just lately some small parcels have arrived containing mostly figured logs, which have met with a ready and good sale.

Cedar.—With the supply so restricted full prices have been paid for the few logs offered, and the outlook is in favour of values advancing, especially for panel and boat building logs.

American Walnut.—There is still a scarcity of good parcels, but inferior logs are going cheap, and boards and planks are being sold freely.

Business continues very discouraging, and complaints are heard from all sides regarding the decrease in the turnover as compared with other years gone by.

Delta Bronze Propeller Blades.—We are informed that Delta bronze is rapidly making its way in favour for propeller blades, and that the following vessels have lately been fitted with them:—s.s. *Catalina*, 4,950 tons, 400 ft. by 48 ft. by 31 ft., built by Charles Connell & Co., and engined by Dunsmuir & Jackson. The propeller is 17 ft. 6 in. in diameter, and 21 ft. pitch, with Delta bronze blades of a weight of 10½ tons. The Indian troopship *Warren Hastings*, built by the Naval Construction and Armaments Co., of Barrow. She is a twin-screw vessel, with propellers 13 ft. 6 in. in diameter and 15 ft. 3 in. pitch, with eight Delta bronze blades, weighing about 26 cwts. each, and we are informed that this vessel made a very successful series of trials both on the measured mile and for six hours' deep-sea run, the contract speed being exceeded by a knot. It is well known that Delta bronze has a very high transverse strength and is not attacked by sea water.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(*From our own Correspondent.*)

As far as can be gathered from reliable sources, very few new orders are going the rounds, and as the outputs are considerable, the amount of tonnage under construction is rapidly decreasing. Messrs. Russell & Co., Port-Glasgow, have contracted to build four large cargo steamers, and Messrs. A. Rodgers & Co., of the same port, have contracted to build a 3,000-ton cargo-carrying steamer for Messrs. Burrell & Son, Glasgow. Messrs. Dunsmuir & Jackson, Glasgow, will supply triple-expansion engines of adequate power. Messrs. D. J. Dunlop & Co., also of Port-Glasgow, have contracted to build a screw tug, to the order of Messrs. A. & W. Dudgeon, London, for service on the river Thames, the builders supplying her with powerful engines for towing purposes. Messrs. Denny, Dumbarton, have, we are informed, received the contract to build a 350 ft. steamer similar to the *Tchikhatchoff*, launched on the 25th July last for the Russian Steam Navigation & Trading Co. of Odessa and St. Petersburg. The only other order of any size placed up to the present time is one for a steel cargo steamer of 1,250 tons gross for Messrs. J. & J. Denholm, Greenock. The receivers of this order are Messrs. Scott & Co., of the same port, and the order is a duplicate of the one noted last issue. The large builders on the Clyde are awaiting with interest the verification of a rumour that the Cunard Co. intend to enter the market for cargo steamers to add to their Atlantic fleet.

Messrs. Ramage & Ferguson, Leith, have received the contract for a steamer of 700 tons for Messrs. Salvesen & Co., Grangemouth.

The total output on the Clyde during the month of May was the second largest for the same month during the past ten years, whilst the output for the first five months of 1893 is about the average for the same period in the past ten years. The following table gives a good idea of the trade up to the end of May as compared with previous years:—

Year.		May. Tons.		First. Five Months. Tons.
1893	...	30,760	...	101,601
1892	...	20,970	...	142,531
1891	...	21,580	...	125,993
1890	...	26,408	...	160,293
1889	...	32,542	...	107,373
1888	...	13,200	...	72,920
1887	...	15,213	...	68,375
1886	...	14,674	...	66,364
1885	...	19,943	...	78,361
1884	...	28,570	...	114,031

Whilst the feature of the launches in May was the number of large steamers, the feature in June has been the number of large sailing vessels launched. Four sailing barques having a total gross tonnage of 12,000 tons having floated in the Clyde up to the time of writing.

At Paisley and Renfrew the various yards are beginning to look bare again, and one or two large orders are the fond hope of the trade just now, though it is impossible to ascertain what prospects the yards have, a judicious silence being maintained when the subject of new orders is brought up.

On the East Coast things are very dull, though a ray of hope is produced, as it is observed that the number of vessels laid up at the Forth and Tay ports is steadily decreasing. On the 12th ult. a serious fire occurred on the north side of the Victoria Dock, Leith, whereby damage to the extent of £16,000 was done. The fire originated in a bale of hemp, and before it could be got under, a shed 500 ft. long by 40 ft. wide, was completely gutted. Two hundred tons of sugar and over one hundred tons of hemp, together with smaller quantities of other goods, perished in the flames. What may seem curious to our readers is the fact that the fire brigade complained of the inadequacy of the water supply.

Very rapid progress is being made with the new Cessnock Dock and a considerable amount of quayage is already available. The new dry docks are also advancing, and already a good idea of the great size of the undertaking can be obtained. We hope in our next issue to be able to lay before our readers some particulars of the progress, also a plan of the dock, which, by the way, is to be the largest in Scotland, having a total area of 38½ acres. The temporary bridge over the Clyde at Jamaica Street is well advanced, and by the time we go to press, will be completely across the river, when it will not take long to prepare for traffic. The old bridge will then be subjected to complete alterations, though it is not definitely fixed as to what the new bridge will be like in every detail. In the meantime traffic through the two bridges is only possible by one arch.

We regret to announce the death, in the beginning of the month, of Mr. J. L. Mitchell, a representative on the Clyde trust of the shipowners and ratepayers of Glasgow. At a meeting held on the 19th inst., Mr. Alex. Mitchell, brother of the deceased gentleman, was nominated for the vacancy and unanimously approved of.

The sand pumping dredger *Jupiter*, built and engined by Messrs. Simons & Co., Renfrew, has broken the Australian dredging record at Maclean, having in one day lifted and discharged 3,000 tons of silt in eight hours. The previous record was 2,000 tons lifted but not discharged, and was held by the river dredger *Neptune*.

In the pig and bar iron trade a distinct improvement is noticeable, and the prices have a very firm tone, whilst in the steel trade the market is much better than it has been for some time past. The copper ore imports to the Clyde for May are put at 4,762 tons, being the largest but one for the corresponding month in the past six years. The total imports of the same ore for the five months ending May are 27,384, being the largest five months for the same period in the past six years.

Amongst numerous large orders for manufactured steel is a large one for boiler tubes for the Admiralty, placed with Messrs. A. & J. Stewart & Clydedale, Limited.

TRADE NOTES FROM THE TYNE, WEAR, TEES, HARTLEPOOLS, &c.

(*From our own Correspondent.*)

THE TYNE.

Shipbuilding.—Contrary to expectation, the joiners employed at the Tyne shipbuilding yards have been so unwise as to come out on strike against a proposed reduction of 1s. per week in the wages rate, and though up to the present their action has not caused much hindrance to work in progress, it has had the equally prejudicial effect of hampering builders in their efforts to obtain new contracts. The step taken by the joiners on this occasion is rendered the less excusable by the fact that all the other sections of men have submitted to a reduction, not excepting even the comparatively low waged labourers. The joiners having always participated in the advances given by the employers in times of rising trade, have no right to claim exemption when the condition of the industry necessitates a genera cutting down of expenses, and, judging by the firm attitudel adopted by the employers in connection with this matter, there is no reason to expect that this unreasonable claim for exemption will be allowed. The employers having obtained reductions from all the other sections, cannot permit one set of men to go scot free, and as they may be trusted not to commit so serious a blunder, this strike may be set down as one for which there can only be one ending, namely, the acceptance by the men of the employers' very moderate proposal.

Since last month there has been a decided increase in the number of enquiries for new tonnage; but the improvement—welcome as it is—seems to have arisen more from the develop, ment of speculative enterprise, than from the existence of any urgent need for further carrying accommodation. Shipowners, finding that prices are about at their lowest, think it advisable to provide for future eventualities, while they can do so on exceptionally favourable terms, and hence the sudden and rather surprising demand for new ships at a time when numbers of old ones are laid up in the ports of the country, because there is not enough work to bring their services into requisition. Whatever the cause, however, there is no doubt that, for the moment, shipbuilding has received a much needed impetus, which, notwithstanding the trade dispute before referred to, is felt even in this district. The owners of the "Prince" line of steamers are getting vessels built at several yards on the Tyne, one firm—Messrs. John Readhead & Sons—having two on the stocks for prospective addition to this well-known fleet. Messrs. the Edwards Shipbuilding Co. have

received from Messrs. Nelson & Donkin, North Shields, an order for two steel steamers of 5,000 tons each, which are intended for employment in the East Indian and American trades. These vessels, which are to be built to Lloyd's highest class, and to be equipped with all the most approved appliances for facilitating the work of taking in and discharging cargo, will be supplied with triple-expansion engines by Messrs. Blair & Co., of Stockton. The Palmer's Shipbuilding and Iron Co., Limited, have three vessels in progress at their Howdon yard, and one of exceptionally large size at their Jarrow establishment. The battleship *Resolution* is being prepared for an early departure to Chatham, where, after delivery to the Admiralty representatives, her equipment will be completed. The sister ship *Revenge* will not be ready to leave the Tyne for some months yet, there being still a good deal of work to be done in the completion of general fittings. Messrs. the Tyne Shipbuilding Co. have secured an important order from a Glasgow shipowning firm, and as they have other work on hand, there is every likelihood of the yard being kept busy for the remainder of the year. Messrs. Hawthorn, Leslie & Co. have put down two keels since last month, and have now four berths occupied. Two of the vessels are for Russian owners, and will be finished in a style of great elaborateness, while the other two, which are being built to the order of a Glasgow firm, are of a type requiring exceptional care in the general details of construction. Low Walker continues to be a busy centre of shipbuilding, each of the three yards presenting an appearance of almost normal activity. This ancient seat of the industry has been specially fortunate during the past twelve months of slackness, as throughout the entire period, the leading establishment (Messrs. Armstrong, Mitchell & Co.'s), has been kept extremely busy.

Almost the whole of the graving docks at Shields are now occupied with vessels undergoing painting or repairs, and the demand for different classes of labour has somewhat improved. The large pontoon constructed by the Smith's Dock Co. with the view of supplementing their repairing facilities, has proved a great success, as by its aid, vessels can be removed from the water to the "stocks," with remarkable quickness, and since it was first brought into requisition some months ago, it has been almost constantly in use. Messrs. Readhead are repairing a large vessel in their graving dock, and are also carrying out some slight repairs to the French steamer *Fautsville*, in the river. The Tyne Dry Dock & Engineering Co., Limited, have had their South Shields dock regularly engaged for several months past, and this is a statement which may be applied with equal accuracy to their dock at Deptford, London, since its opening, eighteen months ago. The s.s. *Hispania*, which was lately sunk by collision in the Thames, and which, after having been completely submerged for some days, was successfully raised by the agents of the Thames Conservancy, has now been placed in the latter dock, where both engines and hull are being subjected to a thorough examination, preparatory to the carrying out of full repairs to both.

Engineering.—Following the slight improvement in shipbuilding, a prospective increase of work in the marine engineering establishments is a tolerably certain contingency, and it is no surprise, therefore, to hear that a few orders have been booked at the marine engine works on the Tyne. The busiest firms are Messrs. Hawthorn, Leslie & Co. (St. Peter's Works), Messrs. W. Richardson & Co. (Neptune Works), the Wallsend Slipway Engineering Co., and Messrs. J. Readhead & Sons. At the Palmer's Co.'s Engine Works business is now slack, but expectations of an early improvement are entertained. The firm has recently carried out, on the engines of a locally-owned steamer, an important alteration contract, which being somewhat of a new departure deserves more than a passing reference. The alteration consists in giving an increase of steam pressure by the simple and comparatively inexpensive expedient of reducing the diameters of the cylinders, which change of structure affects an increase of speed along with a distinct economization of fuel. The vessel that has been the first to undergo this treatment at the Palmer's Works has since had her machinery fully tested on a trial trip, when the results obtained were most satisfactory. Messrs. Black & Hawthorn's and also Messrs. R. Stephenson & Co.'s works are, and have been for some time past, very inactive; but at the last named establishm[illegible] the manufacture of a new type of oil engine has been co[illegible]d, and it is expected that this will give an impe[illegible] usiness of this well-known firm very shortly. The [illegible] s advantages which are bound to make it acceptable in many cases where steam or gas power could not be readily made available, and there is little reason to doubt that as these advantages become more widely known the demand for the engine will be greatly stimulated. One of these engines has been placed on exhibition at the Royal Agricultural Show, which at the time of writing is being held at Chester. Messrs. Allen & Robson, of Collingwood Street, Newcastle, are just now having numerous orders from local manufacturing firms for supplies of "Magnolia Metal," and during the whole of this year their sales of this speciality have been very large. The firm have just concluded arrangements for introducing into England a new anti-fouling paint for ships' bottoms, which has already obtained a high reputation in Germany, where it has been applied with excellent results to a number of notable vessels, including the Emperor's yacht *Meteor*, and most of the important vessels belonging to the German navy. Messrs. Donkin & Co. (late Donkin & Nichol), have received a number of orders lately for special fans, to be used in exhausting the gaseous vapour which is found to be present in the tanks of petroleum steamers after discharge of cargo, and which constitutes a source of danger from its liability to explode. Among local shipbuilding firms who have ordered fans of this description are Messrs. Armstrong, Mitchell & Co. and Messrs. C. S. Swan & Hunter. Mr. W. F. Snowdon, 32, Side, Newcastle, has successfully introduced in this locality a new speciality named the "Pulsator Economiser," for marine engines. Its purpose is to save coal, packing, &c., by preventing the accumulation of water in engines, and as it has already been adopted by many of the leading steamship companies, its success seems assured.

THE WEAR.

Shipbuilding.—While the Tyne shipjoiners are idling away their time and wasting their energies in resisting the employers' proposal to reduce their wages to an equal extent as that agreed to by other sections, the Sunderland men are having the same question amicably settled through the medium of the Conciliation and Arbitration Board. Not, indeed, that there is anything to arbitrate upon—for the acceptance of the employers' proposal by all the other sections of men has practically settled the question—but still it is very satisfactory that the barbarity of a strike has, in this instance, been avoided. The joiners, of course, remain at work pending the decision of the arbitrators, and this is one of the great advantages resulting from the system. Messrs. W. Doxford & Sons have launched the "whaleback" vessel referred to in last month's Notes, and it is understood that the firm have several other vessels of various types to proceed with. Messrs. Short Bros. have also some vessels to build, besides those now on the stocks, and they have an important repair contract to carry out on the locally-owned steamer *John Anderson*, which has suffered damage through having been ashore. The outlook at Messrs. R. Thompson & Sons' yard is not very encouraging, as there are but two vessels on the stocks, one of which is nearly completed. At Mr. Laing's yard business is still active, and likely to continue so, as, besides the five large vessels that are in various stages of construction on the stocks, one or two others are said to be in preparation. The Sunderland Shipbuilding Co. have in course of construction a large vessel, which is intended for the Australian trade, and as they have other work in hand, the state of business at this yard is very satisfactory. At the yard of Messrs. J. L. Thompson & Sons, the whole of the berths continue to be occupied, there being usually a vessel to put down as soon as one is launched. The reputation of this firm for turning out work of a high class with unusual promptitude, has been earned by the exercise of constant vigilance on the part of the management to keep the productive facilities of the establishment "up to date," and the circumstance that the firm are always able to obtain a good proportion of such work as may be in the market, goes far to prove that such methods of conducting business produce satisfactory results. A return of shipbuilding on the Wear, which has just been issued, shows that five out of the thirteen firms on the river launched no vessels during the past six months, while the total output of the eight establishments which did put vessels off the stocks, amounted to only 49,594 tons, which, as compared with the output in the corresponding half of last year, shows a falling off of 37,393 tons. The award of the arbitrators appointed under the rules of the Conciliation Board to adjudicate upon the question of dispute between the employers and the shipowners, has been made known, and is to the effect that the wages of the latter be reduced 1s. per week from the 26th inst.

Engineering.—The marine engine works remain slack, and, excepting in one instance, suspensions of hands are of weekly occurrence. Conjointly with a prospect of improvement in the shipbuilding trade, however, the outlook in the engineering industry has become brighter, and there is some likelihood that in the course of a few weeks employers may find it possible to enlarge the scope of their operations, and thereby provide employment for some of the operatives who are now idle. The smaller engineering establishments, are generally short of work, but there are exceptions, and among the latter may be mentioned the Bloomfield Engine Works, owned by Mr. A. A. Rickaby, where for some time past business has been fairly active. It is understood that Mr. John Wigham, engineer and ship repairer, South Hylton, is bringing out a new speciality for deck use on steamships, and of this we hope to give particulars in a future issue. Foundries and forges are still slack, but hopes of an early improvement are entertained. The Monkwearmouth Iron Works are busier than they were some weeks ago, and it is gratifying to be able to state, that the improvement is likely to be maintained. Chain and Anchor Works are inactive, but enquiries have increased lately, and there is a prospect of business improving shortly. While on the subject of anchors, it may be stated that Mr. George Tyzack, of South Shields, has lately booked a number of orders for his latest type of stockless anchors, from shipbuilders in this district, as well as at other important centres. Messrs. M. Robson & Sons, Monkwearmouth, have received a number of orders for ships' boats, and this department of their works is now very busy. Among the orders booked is one of considerable importance from a firm of London shipowners.

The Hartlepools.—Local shipbuilding yards are still fairly well off for work, and in ship repairing there is a fair amount of work doing. Since last month several contracts have been turned out from the Central Marine Engine Works. No less than three vessels have been sent to sea within the month, the first being the s.s. *Burma*, a vessel built for Austrian owners, having engines 24 in., 38 in., 64 in., by 42 in. stroke. There was also the s.s. *Elax*, which is the fourth of the large steamers ordered from Messrs. Wm. Gray & Co., by Messrs. Samuel & Co., of London, for employment in the bulk petroleum trade, to the East, through the Suez Canal. Her engines are of the usual type built at the Central Marine Works, having cylinders 26 in., by 42 ft., 70 ft. by 45 ft. stroke, and to meet the exigencies of the oil carrying arrangements, they are placed in the after part of the vessel. It is confidently anticipated that this vessel will prove as completely successful as those which already have been built and equipped for this special trade at West Hartlepool, and whose working has been commented on in previous issues of this journal. The third vessel which was sent on its maiden voyage this month, was the s.s. *Penarth*, a large boat built by Messrs. Wm. Gray & Co., for Messrs. Morel Bros., of Cardiff, and supplied with engines 24 in., 38 in., 64 in. by 42 in. stroke, at the Central Marine Works. The trials of these vessels, it may be added, were all of a very satisfactory character.

Mudd's Patent Tail Shaft Preserver, which we described and illustrated in our last issue, has already met with the approval of a considerable number of engineers and managing owners, and has been fitted on the shafts of a good many vessels—both new and old—at Central Engine Works.

The reduction of wages which was rendered necessary by the depressed state of trade, has been arranged without hitch or stoppage, in all departments of the works, excepting the iron foundry, where the men resisted the reduction, although asked to submit to no more than the operatives in the other departments. The men have, at the time of writing, been idle about a month, but as castings are being brought from other districts, no real diminution has taken place in the general output of work.

Stockton.—Messrs. Ropner & Sons have secured an order from Messrs. Watts, Ward & Co., London and Newcastle, for three 5,000-ton steamers, and there is now no doubt that this establishment will be kept busy for the remainder of the year.

Messrs. Blair & Co. have lately booked some important orders, and work prospects at the establishment have much improved. The following vessels engined by Messrs. Blair & Co., have since last month had their trial trips:—The s.s. *Creole Prince*, built by Messrs. Short Bros., Sunderland, for James Knott, Esq., Newcastle, having engines with cylinders 22 in., 36 in. by 59 in. by 39 in stroke. The s.s. *Plympton*, built by Messrs. Furness, Withy & Co., of West Hartlepool, for Messrs. the Commercial Steamships Co., Limited, of London, having engines with cylinders 23 in., 38 in. 62½ in. by 42 in. stroke. The ss. *Eva*, built by Messrs. Ropner & Son of Stockton, for Messrs. C. Michelsen & Co., of Bergen, Norway, having engines with cylinders 22½ in., 37 in., 61 in. by 42 in. stroke. The engines for all these vessels are constructed to work at 160 lbs. pressure of steam, and on the trials, gave full satisfaction.

Middlesbro'.—Messrs. Raylton, Dixon & Co. have received from the Hansa Steam Shipping Co. of Bremen an order for a large steel steamer, similar to one they are now building for the same owners. This firm have also secured orders for two vessels of small dimensions. Messrs. Craggs have obtained an order for two vessels of very fine lines and high speed to be employed in the fruit trade.

Messrs. William Harkess & Son launched on June 15th a vessel of a special type, ordered by Messrs. J. Burnett & Sons, London, for their fast line of steamers running between London and Paris. To enable her to go under the bridges on the Seine her masts, funnel, &c., are made to lower by special machinery. Her engines are being fitted by Messrs. Westgarth, English & Co., who just now have a fair supply of other work in hand, as well as marine engines and boilers.

Consett.—Since the beginning of the present month enquiries for steel plates and angles have largely increased, and a considerable advance in prices is now to be noted. The Consett Iron and Steel Co.'s Works have become even busier than they were a month ago, and at other establishments business has also improved, one firm in South Durham having secured an Admiralty order for 7,500 tons of steel plates.

NORTH-WEST OF ENGLAND.

(*From our own Correspondent.*)

Barrow-in-Furness.—There is a very dull report to give of the shipbuilding and engineering trades of the North-West of England this month. The demand for new tonnage seems to have fallen to a lower point than ever, and it is evident that even cheap prices will not tempt owners to order vessels to any large extent at the present time. Steamship owners are alive to the importance of building new steamers at times like this when the cost of labour and of building material is so low, but they are slow to risk the speculation in view of a cheerless prospect as to when shipping will be again well employed. It is urged that one way to improve matters is to break up a deal of the old tonnage which is now lying idle, and which cannot possibly be again profitably employed in competition with the modern type of triple-expansion engine with which all new steamers are fitted. The few orders which are in the market are most keenly competed for, and builders are all agreed that it is next to impossible at the present time to secure any orders which can yield a profit. No new orders have been secured at Barrow during the month, and prospects are not in any sense assuring. A couple of repair orders have come to hand, one in the case of the s.s. *Cuban*, which met with an accident on the Gold Coast, and another in the case of the s.s. *Barbadian*, which is having her saloon accommodation increased. During the month the sand dredger *Brancker*, built for the Mersey Dock and Harbour Board, has not only been very satisfactorily tested in Morecambe Bay, but has been in operation on the Mersey Bar, and has there done very good work and shown her capacity for removing the vast bed of sand which at this point blocks the free way to the deep waters of the upper reaches of the river. What is most satisfactory in connection with the dredging operations of the Mersey is that as the work proceeds and as the sand is pumped up into the hoppers, the natural swim of the tide, and the outward rush of the waters of the Mersey clears away a deeper and a deeper channel every day. Soon with the help of the dredger the largest class of shipping will gain access to the river at all states of the tide. The Indian troopship, *Warren Hastings*, went on trial in the early part of the month, and both on the measured mile and her deep sea trials, she exceeded her guaranteed speed of 16 knots by 1½ knots, and she is expected to improve on this speed. She is now receiving the final touches of her equipment in the docks at Barrow, and will sail from Barrow direct for Bombay during July. Lord Ashburton's new steam yacht is now practically ready for delivery. She is a grand specimen of the modern steam yacht, and in her fittings, engine power, and other details, will doubtless prove a rival to many of the crack yachts afloat. The s.s. *Accra*, built for the British and African Steam Navigation Co., is nearly

ready for sea, and two other steamers for the same company are in course of erection in the yard of the Naval Construction and Armaments Co.

West Cumberland.—In West Cumberland there is not much life in the shipbuilding trade. At Whitehaven nothing whatever is being done, the yard having been closed there for some years. At Workington and Maryport there is a steady but quiet business in the smaller class of shipping, and this is likely to continue, as there is generally a good market for the ships built here.

Shipbuilding Material.—There is naturally a very quiet demand for shipbuilding material at the present time. Orders are very scarce, and none are coming to the West Coast for plates, angles, &c., because local makers are still unable to compete in the trade of 7s. 6d. to 10s. per ton, but some good orders for heavy steel castings for shipbuilding purposes have recently been placed with the Barrow Steel Co. from Belfast and elsewhere, and this department of the local steel trade is fairly well employed as a consequence.

Business Embarrassment.—Messrs. Westray, Copeland & Co., Limited, have issued a circular to their creditors, owing to bad trade, and losses entailed in working, but it is intimated that the creditors will be paid in full. It is nevertheless a blow to Barrow, as after the Steel Co.'s works and the Naval Construction and Armaments Co.'s works this is the next largest industry.

THE MERSEY.

(From our own Correspondent.)

THE outlook in the marine engineering and shipbuilding industries of this district is perhaps not quite so altogether discouraging as reported of late, but it can scarcely be said that there is any real improvement to be noticed. Rather more enquiry, if anything, has been coming forward among shipbuilders, but no new orders of any consequence have been secured, and the position at the shipyards on both sides of the Mersey remains very much what has been reported for several months past. With regard to Messrs. Laird Bros., of Birkenhead, there is nothing of any special moment to report beyond that H.M.S. *Onyx*, of 3,500 H.P., built and equipped by the above firm, has just successfully completed her trials at Sheerness, and a speed of 19 knots has been obtained under forced draught. The *Renard*, a sister ship, is also practically completed, and will leave Messrs. Laird Bros. early this month for the Dockyard. Amongst marine engineers there is a continued absence of new work of any importance giving out, and they have very little to keep them going except repair jobs and alterations, or re-arrangement of engines, but some of the boiler-makers have a fair amount of work in hand, in refitting with high-pressure boilers, which have now to be put in to meet present requirements. The general engineering trade remains without much improvement; here and there works are perhaps rather busier than they have been, but it is chiefly upon heavy engine work, largely for abroad. Machine tool makers are still for the most part only indifferently supplied with orders, very few of them having work of any weight in hand. Even where they are the best situated, orders as a rule come forward only from hand to mouth, and the outlook ahead continues very unsatisfactory.

An improvement in the construction of the boilers, applicable to those of the small marine and locomotive type, has been patented by Mr. Malham, of Manchester, which, although it is still only in the experimental stage, will be interesting to our readers. The object of this invention is to increase the heating surface and water space, and to dispense with roofing bars or stays of any kind, as far as possible. Mr. Malham introduces a special design of crown plate with corrugations running right across, the flanges for securing the side plates of the fire-box, being at right angles, with the result that there is no weak point where the corrugations terminate. By this arrangement, the steam comes on the direct line of the rivets that join the crown plate on the side plate to the fire-box, and it is claimed that by this method sufficient strength can be secured so that almost all roof stays can be dispensed with. His mode of corrugating the side sheets is so arranged as to get the same grate area in the fire-box as an ordinary box, by allowing the corrugations to terminate at or near the line of the grate bars, and the heating surface in the side sheets, as well as in the crown plate is, by this means considerably increased, whilst the water space is also enlarged, and at a point where it is most advantageous to economy in working the boiler. To this box is added what may be termed a wet bottom, or water space, under the grate bars, and provision is made for the dirt and mud to be blown off, so that the top and the sides of the fire-box are much cleaner, and will in consequence last considerably longer. The smoke-box is encased so as to get dry steam, also to utilise as much as possible all the heat that passes through the tubes, and by this arrangement the heating surface is again considerably increased.

In the iron trade business has been showing more animation with the close of the month, with a slight upward tendency in prices. This, however, can scarcely be said to have been due to any actually increased consumption, but rather to the fact that merchants, who in many cases are oversold at low figures, have been anxious to cover, whilst users who have been buying only from hand to mouth, have shown a disposition to purchase more freely directly there was any indication of prices having touched the bottom. Local brands of pig-iron are not quotably advanced to any appreciable extent, but makers are much firmer. District brands offering here have, however, gone up quite 6d. to 1s. per ton, and Lincolnshire makers with the commencement of the present month are discontinuing their allowance of 2½ per cent. A fair amount of business has been done in Lincolnshire iron at about 35s. to 35s. 6d. for forge, and 36s. to 36s. 6d. for foundry, less 2½ at the works, and some of the makers are now indifferent about booking further. Middlesbrough iron has advanced during the month quite 1s. per ton, good foundry brands, delivered in this district, not now being quoted at anything under about 43s. 6d. to 44s., whilst in Scotch iron Eglinton is 9d. to 1s. dearer, being quoted at 44s. 9d. to 45s., and Glengarnock at 45s. 6d. net prompt cash, delivered at the Lancashire ports.

The steel trade has also shown some indication of improvement, although no very great weight of business has been put through, and during the month very low prices have been taken to effect sales. Foundry hematites, delivered in this district, have been bought in quantities as low as 50s. and 51s., less 2½, but for small parcels makers are not now quoting under 54s. and 54s. 6d. Billets are showing rather more steadiness, but common qualities are obtainable very low, and can be bought at £4 to £4 2s. 6d., with the best qualities quoted at £4 6s. 3d. to £4 6s. 9d., net cash, delivered. In boiler plates there has been some very keen cutting, and for good qualities there have been sellers at as low as £6 per ton, delivered in this district, but prices at the close have stiffened up somewhat, and £6 5s. to £6 7s. 6d. are about the average figures which the best makers are asking. In ship-plates prices have also been excessively low, but there is so little doing in this district that they have scarcely been tested.

Manufactured iron has scarcely shared in the slight improvement which has been noticeable in other branches of the trade, and whilst pig-iron has been stiffening, the hoop iron makers have found it necessary to reduce their list rates 2s. 6d. per ton. In bars there have been some fair lines placed, but at no better prices, Lancashire makers being still open to take £5 7s. 6d. to £5 10s., with Staffordshire obtainable at £5 10s. to £5 12s. 6d., Lancashire sheets, £7 to £7 5s., and Staffordshire £7 7s. 6d. to £7 10s., with list rates for hoops at £5 17s. 6d. for random, and £6 2s. 6d. for special cut lengths, delivered in this district.

In the metal market there has been only a slow hand-to-mouth business doing during the past month, owing to buyers holding back in anticipation of some reduction in list rates, but these have remained without change, and for delivery in this district continue about as under:—Solid drawn brass boiler tubes, 5¼d.; solid drawn brass surface condenser tubes, 7d.; solid drawn copper tubes, 7½d.; brazed copper gas and steam tubes, 7d.; brazed brass gas tube, 6½d.; brass wire, 5¼d.; copper wire, 6½d.; rolled brass, 5¼d.; sheet brass, 6¼d.; copper sheets, 8½d.; yellow metal bolts, 5½d.; yellow metal condenser plates, 5½d.; cast composition sheathing nails and spikes, 5¾d.; cast red metal sheathing nails and spikes, 7½d.; wrought copper rivets, 8½d.; wrought copper boat nails, 8½d. to 9½d.; wrought copper tacks, 11½d. to 1s. 2½d.; cut copper nails, 8d. to 9½d. per lb., and copper bolts £61 per ton.

In the timber trade business has continued very quiet, the demand all through very sluggish, and values generally unsatisfactory. Stocks continue plentiful, and in some articles considerably in excess of requirements. There has been a small import of East India teak, but the consumption has only been limited, and moderate stocks remain, with prices fairly steady. With regard to greenheart the market is getting into an unsatisfactory position. Market cargoes continue to arrive without

finding buyers, even at reduced prices, and these cargoes have to be yarded, thus adding to the previously heavy stock.

The coal trade continues in a very depressed condition generally, with collieries barely working half time, and considerable stocks accumulating. All descriptions of round coal are a drug upon the market, and only saleable in anything like quantities at very low figures. This is especially the case in the lower qualities suitable for iron making and steam purposes, 6s. to 6s. 6d. representing about the average figures at the pit-mouth, whilst for shipping requirements prices are cut down perhaps to an even lower point than has been known for a very long time past. Delivered at the Garston Docks or the High Level, Liverpool, ordinary descriptions of steam coal scarcely average more than 7s. 6d. to 8s. per ton, and there are sellers at even under 7s. 6d. per ton. The contracts for locomotive fuel have this year been placed very low, quite 1s. under last year's prices. The only strong section of the market is with regard to engine fuel, and this is not so much due to any large demand as to the very restricted production of slack, owing to the depressed condition of the round coal trade. As a consequence there is a scarcity of supplies in the market to meet the requirements of consumers, and prices have been hardening up during the month. At the pit mouth good qualities of burgy range from 6s. 3d. to 6s. 9d., best qualities of slack from 5s. 3d. to 5s. 6d., and common at 4s. to 4s. 3d. per ton.

NOTES FROM THE WEST.

(From our Special Correspondent.)

Chicago, 25th May.

FROM a strictly scientific point of view, the Exposition is not a success. For the *dilettante*, it is all that could be desired. No other city in the world would have expended so much money upon mere temporary buildings for exhibition purposes. No other centre could attract such a motley crowd of visitors. This "city of the winds" has, for the time being, collected chaff from every corner of the world. This calling together of more or less representative men from all nations may have far reaching and permanent effects in many ways, but it may seriously be doubted whether the educational value of time spent in such a conglomerate mass is worth the great efforts made. Expressions of surprise at the rather meagre show made by Great Britain, are heard on every side, but in six months from now different ideas will prevail. English manufacturers and merchants have done well to keep quiet on this occasion, whatever may be the actual cause of their holding aloof from the "World's Fair."

The opportunities afforded of inspecting some of the principal shipbuilding yards on this side of the Atlantic compensate one, however, for any disappointment that may be felt at the incomplete character, and somewhat disorderly arrangement of the machinery and transportation sections of the Chicago Exhibition.

Some particulars of the present state of marine engineering in this country will prove of greater interest to readers of THE MARINE ENGINEER than details of exhibits which are already too well known to require illustration.

An important event of the past week has been the first trip of the *Christopher Columbus*, a whaleback steamer especially designed for passenger accommodation on Lake Michigan. It is the first passenger whaleback ever built, and anyone with an eye to the beautiful will sincerely hope it may be the last. It was built from the designs of Commander Alexander McDougall, the pioneer of the "whaleback" for freight purposes. The *Christopher Columbus* presents as strange an appearance as the old high decked vessels that were used in the days of the adventurous discoverer whose name it bears. Three decks rise above the whaleback, and tower in the air like the circles in an amphitheatre. The arrangement of the decks above the cylinder is unique, and may perhaps give the sea-sick passengers a sense of comfort and safety which is absent on other big passenger boats. The vessel was begun September 6th, 1892, and completed and launched December 3rd, 1892. The monster steel cylinder is 362 ft. long, with a beam of 42 ft., and a depth of 24 ft. Triple-expansion engines with three cylinders 20 in., 24 in. and 70 in. in diameter, lie in the torpedo-like steel shell with 2,600 H.P. The whaleback is able to leap over the waves at the rate of twenty miles an hour. During the voyage from Duluth to Chicago, the vessel went at the rate of eighteen miles an hour. The bottom of the cylinder has nine watertight compartments for a water ballast of 730 tons, which serves to keep the vessel in an upright position. Seven turrets support the decks. There are five decks altogether, including the main, the promenade, the turret, and the hurricane. In the cylinder is another deck, where the restaurant and dining-room are to be managed. Along the promenade deck runs the grand saloon, 225 ft. long, by 60 ft. wide, with a ladies' cabin aft; the decorations of the saloon are handsome and luxurious. In the centre of the saloon rises a fountain, which trickles down a crystal globe into an aquarium below. On the windows designs of ships, from Noah's ark to the whaleback, are engraved. The captain's cabin, the wheel-house, and the officers' quarters are on the promenade deck. Everything is painted white down to the water-line.

The officers of the whaleback are Mr. John McArthur, captain; Alexander E. McGregor, first officer; R. E. Ritchie, first mate; Geo. R. McPherson, second mate, and Robert Armstrong, chief engineer, with a crew of forty-five men.

Another important event was the launch of the *Manitou*, a large steel steamer, from the yard of the South Chicago Shipbuilding Co., on the Calumet river, on Saturday, 20th May, built for the Lake Michigan and Lake Superior Transit Co The vessel is 295 ft. long and 42 ft. beam. Motive power will be supplied by a set of triple-expansion engines constructed by the Cleveland Shipbuilding Co., Cleveland, U.S.A., by which a speed of from 15 to 16 miles per hour is expected to be attained. The steamers built by this company are for passenger traffic on the great lakes.

The Chicago shipbuilding yard was established in 1890, and is capable of turning out vessels of the best type for lake navigation. Prior to 1890, no iron or steel vessels had been built at Chicago. This new enterprise was started by experienced steel shipbuilders. The works are located on the Calumet River at South Chicago, about a mile above its entrance into Lake Michigan. With a river frontage of about 1,400 ft., and an average depth of over 600 ft., the works cover over 20 acres, affording ample room for the shops necessary for all the various trades and occupations concerned in the building of the complete ship, with large storage ground for material besides. At the south end of the property, three slips, each 400 ft. long by 100 ft. wide, have been excavated to a depth of 12 ft. of water, at a right angle to the river, whose sides give berths for building six ships of the largest class at one time, which will be launched sideways into the slips. Across the heads of the slips, equally convenient and accessible to all the berths, stretches a building 540 ft. long, by 75 ft. wide, containing the boilers and shop engines, heating furnaces for plates and angles, blacksmith's shop, plate and angle shops, small machine shop and pattern shop; and in the second storey a mould loft with a clear floor 200 ft. by 50 ft.

A conspicuous feature in the marine exhibit, situated in the gallery of the transportation building at the exhibition, is a model of the projected Nicaraguan Canal. It consists of a long relief map or topographical model of the district through which the canal is proposed to be constructed, and is certainly one of the most complete and interesting things of its kind ever devised. Mr. P. H. Bevier, the assistant engineer of the Nicaraguan Canal Construction Co., of New York, explains to visitors the various points in the construction, and dilates particularly upon the ease and speed with which his company will get the canal completed when the required capital of one hundred million dollars is raised. The model is made of plaster of Paris, 30 ft. long by 6 ft. broad, and cost about three thousand dollars. It is drawn to scale, longitudinally and horizontally. The topographical outline shows a map of the entire isthmus through which the surveys have been made. The altitudes of the hills, mountains, and valleys are reproduced in miniature, and so far as surveys have been made, these are proportionately accurate. Two mountain peaks are respectively 5,350 ft. and 4,200 ft. in height. These towering peaks and some other smaller ones are faithfully reproduced.

One of the features that make the Nicaraguan Canal exhibit of peculiar interest to visitors is that is a working exhibit. A constant stream of fresh water is supplied by lead pipes. This water passes through all the streams, natural and artificial, that are portrayed on the map, and fills Lake Nicaragua in the centre. It passes out to the exterior basins on the left, which are the Atlantic and Pacific Oceans respectively, and is then discharged through exhaust pipes. The idea is to convey to the minds of the spectators a graphic illustration of the Nicaraguan Canal as it will be completed, and also the lakes, rivers, and other free navigation from ocean to ocean which will be utilized as a part

of the system. The relief map is, of course, an ideal picture. The surveys so far are only preliminary in character, except on the eastern or Atlantic slope, where excavation is in progress. The Nicaraguan Canal exhibit will be of special interest to Americans, because of the interest that has from time to time been shown in the progress of the work by the United States Government. There are, practically, two factions in congress, one advocating Government control of the Nicaraguan Canal, and the other opposed to any subsidies of such character. The Nicaraguan Canal project is nearly fifty years old. It is much older than the Panama Canal project, but did not assume definite shape till 1887, when the present Canal Construction Corporation was formed. The Corporation has already spent about one million sterling in surveys and other preliminary work.

It is estimated that it will require about twenty millions sterling to complete the canal. This is the highest figure of all the estimates made, and it includes expenses of every kind, such as the floating of bonds. It is claimed that the system can be comple ted from the beginning for less money than the Panama Canal system could be completed, even after the enormous expenditures already made in the latter work. The Nicaraguan system is about 250 miles north-west of the Panama system, and according to conservative authorities is much more favourably situated as regards climate and trade winds from the ocean.

The total distance from ocean to ocean of the Nicaraguan system is 169 miles. The amount of canal in excavation is 26 miles; length of basins, 21 miles; River San Juan, 64 miles; Lake Nicaragua, 56 miles; and free navigation in lake, river, and basins, 142 miles. The elevation of summit level of canal above sea level is 110 ft., and the length of summit level, 154 miles. The number of locks is 6; greatest lift of locks, 45 ft.; dimensions of locks, 650 ft. long and 80 ft. wide. The depth of canal is 30 ft., and the least width on bottom, 100 ft. The time of transit from ocean to ocean is estimated at 28 hours. The length of Lake Nicaragua is 110 miles, and its average width is 40 miles. The surface area of the lake is about 2,600 square miles, and the area of the watershed of the lake about 8,000 square miles. The harbour on the Atlantic coast is called Greytown, and here the Canal Company has to deepen the natural bed of the harbour. On the Pacific coast the harbour is called Brito, and this harbour has to be excavated.

THE DISASTER IN THE MEDITERRANEAN.

On Friday, June 23rd, news came to London of naval disaster such as has not been received since nearly a quarter of a century ago we learnt the sad story of the loss of the *Captain*, off Cape Finisterre. The catastrophe which startled the world is the sinking of the *Victoria*, the flagship of Admiral Sir George Tryon, Commander-in-Chief in the Mediterranean, by collision with the *Camperdown*, which vessel at the time of the mishap was flying the flag of Rear-Admiral Markham. More terrible to relate, we have not alone the loss of this magnificent ship to deplore, but that of the distinguished Admiral and nearly two-thirds of her crew of seven hundred souls. A squadron of eight battleships and several cruisers was at the time of the disaster manœuvring off the Coast of Syria, and on the afternoon of June 22nd, about half-past three, approached the bay of Tripoli. Thereupon signal was made by Sir George Tryon to the squadron, which had the effect of altering the relative bearing and distances of the ships one from the other. It was in the performance of this manœuvre that the *Camperdown* came into collision with the *Victoria*, the ram of the former vessel striking the side of the latter just before the turret on the starboard side. The blow may have been direct, or it may have been a glancing one, most likely it was the latter, but in either case the damage done to the vessel rammed was such that she began to fill at once, and then, to everyone's astonishment, turned right over and sank bottom up, being actually out of sight in less than fifteen minutes from the moment of collision.

At the time of our going to press this is the sum total of the official information vouchsafed to us. More, it is understood, is being despatched to England by the P. & O. steamer, which left Port Said on June 26th, but everything else is conjecture, speculation, and surmise. Two questions are raised by the disaster. The first, How did the mishap occur? was it by fault of the machinery or a human blunder? The second, Why did the ship capsize? Was it because of her construction or in spite of it? For a reply to the first of these questions we must await the result of the court-martial which will be held on the officers of the ship which has gone to the bottom. For an elucidation of the second mystery it may be that we shall have to wait for ever, but whether this is so or not it is hardly necessary in a professional journal to plead for time and consideration of all the available information before forming an unalterable opinion. In any event we are not likely to learn anything more about the power of the ram than we knew before. Indeed, it is highly probable that if the respective commanders of the two vessels had desired to bring about the catastrophe they could not have done so. Ramming will seldom be resorted to in action, unless to give the *coup de grace* to an already disabled enemy.

H.M.S. "Victoria."

The *Victoria* was ordered by Lord Northbrook at the time of the "Truth about the Navy" scare. Her first rivet was driven by Sir Wm. Armstrong in June, 1885, and she was launched from the Elswick Shipyard, April 9th, 1887, her name, which had previously been *Renown*, being altered to *Victoria* in honour of the Queen's Jubilee. She was a steel-armoured battleship of 10,470 tons displacement; her length was 340 ft., beam 70 ft., and maximum load draught 26 ft. 8 in. With forced draught she was designed to have 14,000 I.H.P., and to steam 16·7 knots an hour. Her battery breastwork was made of 18 in. and her turret of 17 in. compound armour. She had also a steel protective deck of 3 in. thickness. Her armament comprised two 111-ton breechloaders carried in the single turret forward, one 10-in. gun in a breastwork abaft, and a secondary battery of twelve 6-in. breechloading, twenty-one quick-firing, and eight machine R.C. guns. She had also six torpedo-launching tubes. For her date her underwater subdivision was excellent; not only was she efficiently subdivided by athwartship bulkheads, but the whole of the vessel was longitudinally divided by a subhead running fore and aft.

H.M.S. "Camperdown."

This first-class battleship is of older date than the *Victoria*. She was built at Portsmouth and launched in 1885. Her engines are of 11,500 I.H.P., and her estimated speed 16·7 knots. Her length is 300 ft., beam 68 ft. 5 in., and maximum load draught 27 ft. 8 in. She carries her armament in two barbettes respectively forward and aft of a casemate containing the secondary battery. In each of the towers is a couple of 13½ in. 67 tons breechloaders, and in addition she carries six 6-in. 5ton breechloaders, fifteen quick-firing, and six machine guns. She has also five torpedo-launching tubes. The *Camperdown* has but recently been sent to the Mediterranean, leaving England last autumn after the manœuvres for which she had been specially mobilised. At the time of the mishap Rear-Admiral Markham had hoisted his flag in her while his proper flagship, the *Trafalgar*, was under repair in Malta dockyard.

Speculative Causes of the Mishap.

At present the actual cause of the disaster is unknown, but it is surmised from the telegraphic despatches received unofficially, that one of two evolutions was being performed. Either the two lines in which the squadron was steaming were being changed, the port for starboard column and *vice versa*, or one single column was being formed of two. In the former case the ships forming the two lines would simultaneously turn outwards and making a complete circle would pass one another, coming up into the two lines again when the prescribed distance was completed. Or the ships turning inwards and towards one another, the vessels of the Rear-Admiral's division would form astern of those in the Vice-Admiral's line, a reversal of course to sixteen points taking place and a counter-march so as to resume the original course. The opinion which most obtains is that the former of these evolutions was taking place, and that for some unexplained reason as the vessels passed one another the *Camperdown* charged the *Victoria*, striking her a glancing blow from the turret aft, and ripping home so many of her compartments as to entirely destroy her stability. The very fact of the longitudinal bulkhead remaining intact with its watertight doors closed would then operate to her destruction. For all along one side the water entering the ship would cause her to sink, while on the other side the still watertight compartments would lift her out of the water. The centre of gravity would thus be materially affected,

the meta-centre would be lifted dangerously high and the tremendous weight of her guns and armour would help to make her turn turtle in the way she unquestionably did.

SIR GEORGE TRYON, HIS OFFICERS AND MEN.

By this deplorable catastrophe we have not only to mourn the loss of Sir George Tryon, an officer of unexampled experience in command of modern fleets, but upwards of four hundred officers and men. The loss of Sir George Tryon is for a time irremediable. His capabilities are well known, a more able officer we have not in the Navy, and his capacity was only equalled by his popularity. He took a prominent part in most of the annual manœuvres which have taught us all so much that is new about the fleet, and as an organiser of the reserves he did more than anyone else to make them an effective factor in the scheme of Imperial defence. Among the lost, too, is by far the greater part of the engine-room complement, officers and men. Fleet Engineer Felix Foreman, a distinguished member of the Devonport naval family, for his father had served before him, was amongst the foremost of the Navy's engineer staff. He was promoted to chief engineer for special work in the *Bittern* in Egypt, and had seen much service both afloat and in charge of the factories. Engineer Harding, although he had no war record, was noted as a painstaking officer, thorough in his work, and coming to the fore as a scientist of no mean ability. The assistant engineers, Messrs. Deadman, Hatherley and Seaton, were like their chief, good men and true, and died at their posts as British seamen and naval officers.

With them perished many other officers and men, the flowers of our naval service. In all probability those saved were on deck at the time of the disaster, and this appears probable not only because the majority of the officers in this category are executives who would naturally be up there, but also because one engineer only has been saved, and it would be the duty of one engineer in such an emergency to attend the captain on deck.

THE LUBRICATION OF MARINE ENGINES.*

BY MR. W. M. ROSS (Member).

MY reasons for bringing this paper before your notice are chiefly, that however well designed and well proportioned a marine engine may be, unless friction be overcome, successful results cannot be obtained, and as in many ways the various methods of dealing with this matter are defective—in fact, they may rather be called adders to the evil, than antidotes of it—I think if a few of the most prominent defects and most radical evils were brought before this Institute, and properly discussed and thrashed out, some greater notice would, perhaps, be given by designers, and by marine engine builders to the various means of applying lubrication, which would prove beneficial to the engine itself, and give a better and most satisfactory condition of life to the engineers. I would here specially ask you to note my intentions are to speak only of some of the methods in use of supplying lubrication to the bearings, and not to the lubricating materials themselves; so numerous are these latter, and so effective and beneficial is their work, according to the various and many advertisements we see, that one wonders why such things as hot bearings ever occur. If we work out the various percentages of savings which we are told will accrue through the use of these many so-called lubricants, taking no consideration of the many special ways they can be applied, I think the results would be a *minus* expenditure instead of the very heavy positive one we find. It is not, however, to this I ask your attention, but to the different methods of distributing these lubricants throughout the engine, showing what I consider the defects, and likewise making a few suggestions as to the more necessary remedies which may be, without any great trouble, adopted.

Defective lubrication has, probably, given a great deal of worry and anxiety to most of those who have been brought closely in contact with marine engines, and in an Institute like this there are very few, I presume, who have not had some experience of the working and troubles of marine engines. On that account I have written this paper, hoping it may induce a discussion on the methods of lubrication generally, and, perhaps, lead to much needed improvements. You may not coincide with my ideas, but I am sure a discussion on this subject will be very beneficial, and tend to useful and practical results, advantageous alike to the shipowners and the marine engineer. Great loss of power must be a necessary consequence of improper lubrication; and loss of power caused through this one defect alone, must of a certainty mean a great augmentation to amount of coal, which in the engineering department of to-day, is, without a doubt, the most serious point of consideration. But not only will this defect show in the coal accounts, it must appear as a serious item in the repair accounts as well, and in the end must certainly touch the pockets of the shareholders and owners. It has been stated by Dr. Thurston, Professor of Cornell University—who, I think, may be quoted as one of our greatest authorities on the subject—in his work on "Friction and Lost Work," that the average loss per annum for an engine of 100 H.P., working a mill, is £100 through friction alone; and if this is computed for a mill engine, it can be no less in a marine engine, in fact, I think the percentage would be greater. A considerable sum you will say; but I think it comes very near the mark. When we look back and consider in our own experience the number of shafts we have had to lift, the number of brasses worn through and requiring new metal, add the time and trouble expended in adjusting bearings, which, if at the first had received more attention in the arrangement of oil supply, would have lasted a much greater length of time. The first cost of a few more feet of piping, and a few more oil boxes distributed around the engine-room, would be very small, compared to the great after expense which must follow through the lack of them.

Many arguments might be brought to bear on this subject and I trust many will be—but I would here ask all to note that the references in this paper are solely to vertical marine engines. No doubt they could be applied to other machinery as well, but as this Institute is principally composed of marine engineers or those intimately connected with marine engineering, and the greatest number of marine engines of the present day are of the vertical type, I hope all arguments will be considered accordingly.

Lubrication may be divided into two classes—external and internal. Let us first consider the external. One of the principal parts of a marine engine is the crank-shaft and its various bearings, to which too much attention can never be given. In boring out bearings for a crank shaft the general rule is to give a greater diameter than the shaft which has to revolve in them, a difference which may vary with the engineers, but in all cases the hardest points to come into action are the top and bottom centres and a gradual enlargement towards the sides. In the method of supplying lubrication to these bearings to which I refer, all oil holes are bored through the top centre, and, to enable the bearing to receive sufficient oil to overcome friction, the outlets have to be greatly enlarged and oil channels cut all over the bearing surface. This I consider wrong, and one of the greatest defects in anti-friction that can occur in any bearing in which the shaft has a revolving motion—as the sides of the bearings (and by that I mean any part away from the top and bottom centres) must have the greatest division of the two metals—in other words less friction, therefore the outlets should be distributed into that space, so that the shaft in revolving will carry its lubrication with it, drawing its supply as from a reservoir—inducing a better flow down the oil pipe instead of retarding it, as must take place when the pipes lead directly to the top centre of the bearings. Were it not for the enlargement of the oil tubes and the channels cut over the surface no lubrication would take place in these bearings at all.

Nearly all main bearings are now fitted with white metal, or some other less tenacious metal than the brass itself, and is generally fitted in the outer brass or cast iron, as the case may be, in strips of about four inches in width, having one division on the top centre into which the oil holes are led. This method has its advantages, but I think if this white metal were to be divided into three services, that is with two intermediate divisions only, we would give the bearing a better opportunity to distribute its work through all the component parts. We require only the bearing surface equal to the diameter of the shaft to ensure a correct bearing, and, instead of the arrangements of the present day, we get the oil supplied into the space on either side, and the whole metal is left as bearing surface on the bottom and top centres—the principal points of these bearings.

I do not think any great inconvenience would be caused by making this alteration. A difference would be required in the design of the cups, but if this can be proved to be the better way of lubrication, and, in consequence add to the life of both bearing and shaft, surely the designers can make the necessary alterations without any great trouble—for it is just as easy to design a thing properly as improperly; I consider therefore, that all bearings in

* Read at a meeting of the Institute of Marine Engineers.

which the working part has a revolving motion should be supplied with lubrication not on the top centre, but at some point away from that centre. Then each side of the bearing will always have a better supply and as a result we would have less friction and consequently greater power.

Let us now consider the lubrication of the crank-pin. The same defect is here seen as in the main bearings, and if it is wrong in one case, here it must show with greater force. The principal defect in crank-pin lubrication, I think, lies in the method of supply from the boxes, as at present fixed in many marine engines. Many of you will still have in your recollection—because it is only of late years the system has been discarded—the long telescopic pipes which carried the supply to a centre box; a more extravagant way could, I am sure, never have been designed. It always seemed to me that half the supply was taken up in lubricating the pipes alone, and let the engineer in charge be as careful as he could, still there was always a great waste, for the pipes never seemed dry. This has happily been improved on, although it still remains in some of our older ships. The method of to-day, although without a doubt a great improvement upon this old style, I think, falls far short of perfection. Let us trace the connections. Generally we have a box fixed high up on the cylinder lagging, with pipes leading to another cup fixed on each side of the connecting rod jaw; from these cups lead other pipes (usually one from each) to another cup, fastened to the centre of the connecting rod, or at such a distance as to give clearance from the bottom corner of the guide, and to be handy for any oil to be given as the rod is working. From this cup run three pipes, one to each side and one to the centre. Now, from this last cup run three outlet pipes, but it has only two supplies, and these two, in five sets of engines out of six, lead directly over the side outlets; the centre pipe gets its supply only by chance. I do not say it never gets any, but I consider that every outlet should have its own special supply. From the first box there should be sufficient oil supplied to guarantee each of the pipes leading into the brass getting its own proper amount regularly, and on no account should this most important bearing be left to chance lubrication, as in some cases at present. We know it is necessary for oil to reach this bearing; it must surely, therefore, give greater satisfaction if the engineer can be certain that every drop reaches its intended part. With engines running at the high speed of to-day, and with the long connecting rods now in use it is impossible for this pin to be oiled except automatically; let the greaser be ever so good, still there must be a great percentage lost when oil has to be supplied in this off-hand manner. How many crank-pin bearings to-day can be run without using the water service, which, although at times a blessing, when considered relatively to the life of the shaft and bearings, is far otherwise. Many an anxious watch is passed, and many a gallon of oil is wasted through the defective supply to a bearing. Yet it can be easily remedied. Of course the old saying may be brought in—"It has gone for so many years, it can surely do now." But I hope I have sufficiently shewn the defect to justify a remedy, as follows:—Place the outlet holes not on the top centre, but somewhere on the sides; give each hole an independent supply pipe, and, if the engine is properly balanced, there will be a much better working pin, and with better working we have less friction, and, consequently, longer life to both pin and bearing.

(*To be continued.*)

A new Pontoon Dock.—Messrs. Edwards' Shipbuilding Co., Limited, Howdon, are at present constructing a large iron pontoon dock for the Manchester Ship Canal Pontoons and Dry Docks Co., Limited. The dimensions are 300 ft. long by 70 ft. broad, and 31 ft. to the top of the towers. There are forty watertight tanks, each 7 ft. deep, which will be filled by four inlet valves, each 18 in. in diameter, two on either side. These valves will be worked from the top of the towers. For the purpose of pumping out the water, after the dock has been sunk and the vessel to be docked has been placed on the blocks, large centrifugal pumps, by Messrs. Tangye, of Birmingham, will be fitted. The whole of the machinery will be placed at the fore part of the dock, and will include, in addition to the pumps, two boilers, 9 ft. diameter and 9 ft. long, by Messrs. J. T. Eltringham & Co., South Shields. The dock is one of Mr. Alexander Taylor's patent, and similar to that built by Messrs. Swan & Hunter, of Wallsend, for the Wallsend Pontoon and Dry Docks Co., Limited. The work was commenced in February last, and has been so expeditiously carried out that it is hoped to launch the dock towards the end of this month. It will then be towed round the coast, and delivered at Ellesmere Point, about six miles up the Manchester Ship Canal. The work has been carried out under the inspection and supervision of Mr. Sharer, general manager, and Mr. A. Swan, outside manager of the builders' firm; and Mr. A. Taylor, the patentee, and Mr. Harrold on behalf of the owners. There have been used in the construction of the dock about 1,500 tons of iron, and nearly 400,000 rivets.

Maria Theresia.—On April 29th the ram cruiser *Maria Theresia* was launched from San Rocco Shipbuilding Yard, near Trieste, for the Austrian Government. The vessel is 841 ft. long, 58 ft. beam, and 19 ft. 6 in. deep. Motive power will be supplied by engines of 9,800 H.P., by which a speed of 19 knots is expected to be attained. The armament will comprise two 9¼ in. guns, four 6 in. guns, two 2¾ in. Krupp breechloading guns, eighteen machine guns, and four torpedo tubes.

Shipbuilding Contract.—Messrs. Ramage & Ferguson, of Leith, have secured an order to build a steamer of about 700 tons for Messrs. J. T. Salvesen & Co., Grangemouth.

A Target Raft.—On May 31st there was launched from the Tynemouth Ship and Yacht Co., Limited, The Strand, Tynemouth, a target raft for prize firing. It was sent off in tow of tug *Regia* same night for Portland. The target is 40 ft. long, and was built to the order of the Admiralty.

Weir's Evaporators.—On May 29th the *Vulcan*, new torpedo depôt ship, which had previously been fitted with distillers, made a trial at Portsmouth of a set of Weir's evaporators, with which she has recently been provided. The trial was satisfactory, the apparatus being able to supply 60 tons of water a day.

Torpedo Boat.—The torpedo boat, No. 177, constructed by the Société de Forges et Chantiers de la Mediterranée at Havre, for the French Government, was recently taken for its trial trip. The vessel is 118 ft. long, 13 ft. 1 in. beam, and 8 ft. 7 in. deep. A speed of 21 knots had been guaranteed, but at the trial the average speed attained was 22.8 knots.

Shipbuilding Contract.—An important order for shipbuilding has been secured by the Edwards' Shipbuilding Co., Limited, North Shields. Mr. Donkin, the member for the borough, has placed in the hands of this firm the building of two steel steamers of fully 5,000 tons each. The engines will be supplied by the firm of Messrs. Blair & Co., of Stockton-on-Tees. This order has been placed at a most opportune time, as the work at present engaging this establishment was pretty well through.

Lansquenet.—*Le Yacht* announces that the French torpedo-boat *Lansquenet*, which was launched at Nantes on May 18th, has undergone her trials, and has attained a speed of 26 knots, or very nearly 30 statute miles an hour. The *Lansquenet* displaces 138 tons, is 165 ft. 4 in. long, and 15 ft. 8 in broad, and draws 4 ft. 3 in. of water. She has twin screws and two triple-expansion engines, which together indicate 2,800 H.P. At present she is the fastest craft in the French navy.

American Cruiser New York.—The new American cruiser *New York*, built by Messrs. Cramp, of Philadelphia, has made her official trial trip off the New England coast east of Cape Ann. The sea was smooth and the weather fine. The course of 83·3 knots was covered in 3 hours 57 minutes at an average speed of 21·07 knots under forced draught. This may be slightly changed after allowance has been made for tidal influences. The average revolutions were 135, and the I.H.P. 17,000. Messrs. Cramps will get a premium of about £40,000 above the contract price for the speed and H.P. obtained. This result, which proves her to be one of the swiftest warships afloat, gives great satisfaction throughout the country.

New Masts, Rigging, &c., for the Somali.—A short time ago the four-masted ship *Somali* was dismasted in a hurricane in the China Sea, and the order was given to Messrs. Russell & Co., shipbuilders, Greenock, to furnish the vessel with 18 new yards, three of which were 92 ft. and six 80 ft. in length. The order also included three topmasts, topgallant and royal masts. In fact, everything above the lower masts were supplied, including rigging, sails, blocks, and chains, and the work was executed and shipped on board steamer at Glasgow for Hong Kong in the short time of 15 days. Captain M'Gill, superintendent of Mr. G. M. Steeves' line of sailing ships, who has just returned from New York, where he superintended the repair of the ship *Solfala*, the cargo of which had been on fire, goes out to Hong Kong to see the repairs on the *Somali* carried out.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—ENGLISH.

Beltor.—On May 30th Messrs. Ropner & Son launched a steel screw-steamer of the following dimensions:—Length between perpendiculars, 315 ft.; breadth, 40 ft. 6 in.; depth, moulded, 23 ft. 7 in. She will be classed 100 A1 at Lloyd's, and carry 4,500 tons deadweight on Lloyd's freeboard. She has raised quarter-deck and partial awning deck, cellular bottom for water ballast, and is built on the web frame principle, having all the latest improvements for a cargo steamer. She will be fitted with triple-expansion engines by Messrs. Blair & Co., of 1,200 I.H.P., with two large steel boilers, working at 160 lbs. She has been built to the order of Messrs. John Holman & Sons, London, under the inspection of their marine superintendent, Captain A. C. Holman. She was named the *Beltor* by Miss Pinkney, of Sunderland.

Glengariff.—On May 30th Messrs. Wigham Richardson & Co. launched, at Newcastle-on-Tyne, a steel screw-steamer named the *Glengariff*, which they are building to the order of the City of Cork Steampacket Co., Limited, of Cork, for their passenger service between Cork and Liverpool. The steamer is being constructed to attain the highest class in Lloyd's Register; she is 275 ft. in length by 35 ft. beam. The engines are of the triple-expansion type.

Ran.—On May 30th Messrs. R. Craggs & Sons launched at Middlesbrough a steel screw-steamer of the following dimensions:—Length, 170 ft.; breadth 27 ft.; depth, moulded, 13 ft. 8 in. She will be fitted with triple-expansion engines by Messrs. Westgarth, English & Co., of Middlesbrough, having cylinders 13 in., 21 in., and 34 in., by 27 in. stroke. The vessel has been built to the order of Mr. D S. Meier, of Christiania, and was christened the *Ran*.

Accra.—On May 31st the Naval Construction and Armaments Co. launched from their yard at Barrow-in-Furness a steel screw steamer of 2,730 tons, built for the British and African Steam Navigation Co. The vessel is 336 ft. long, 39 ft. 3 in. beam, and 25 ft. 8 in. deep.

Alecto.—On Wednesday afternoon, May 31st, Messrs. Richardson, Duck & Co. launched from their yard a steel spar-decked screw-steamer of the following dimensions:—Length over all, 357 ft. 6 in.; breadth, extreme, 48 ft.; depth, moulded, 29 ft. 9 in.; tonnage, gross, about 3,600 tons. This vessel, which has been built to the order of Messrs. Thos. Wilson, Sons & Co., Limited, Hull, is classed 100 A1 on Lloyd's registry, and has been built under special survey. She has a bridge amidships, with accommodation for passengers, officers, engineers and firemen in deckhouses on bridge deck, a topgallant forecastle, in which sailors and petty officers are berthed, and a hood aft with iron house over steering gear. A cellular double bottom throughout and peak tanks are fitted for water ballast; the collision bulkhead is made cone-shaped for greater strength. The vessel will be rigged as a two-masted schooner, and her equipment includes six steam winches by Messrs. Amos & Smith, who also supply the steam steering-gear, which is placed at the after end of engine-room, and worked from the wheel house by shafting; steam windlass by Messrs. Clarke, Chapman & Co.; Tysack's stockless anchors; double derricks to hatches; light towers on forecastle for sidelights; steam fire-extinguishing pipes in holds and 'tween decks, &c. The engines will be fitted by Messrs. Amos & Smith, of Hull, having cylinders 24 in., 38 in. and 64 in. by 42 in. stroke, steam being supplied by three single-ended boilers working at 180 lbs. pressure. The vessel has been constructed under the superintendence of Mr. J. F. Wilkins, who will also overlook the fitting-out. The christening ceremony was gracefully performed by Mrs. C. W. Littleboy, who named the vessel *Alecto*.

Queen of the Fal.—On May 31st, shortly after 5 p.m., the new steamer, *Queen of the Fal*, was launched at the shipbuilding and engineering works of Messrs. Cox & Co., Falmouth. A platform, with stairs and handrails, was erected at the bows of the vessel, decorated with a gay display of flags, and occupied by Mrs. Benney and other owners of the vessel, also members of the firm and their families, and Mrs. and the Misses Searle, &c. The steamer *New Resolute* brought down from Truro a numerous party to see the launch, and precisely on her arrival the dog shores were knocked away, and the vessel glided noiselessly and gracefully into the sea, amidst the loud cheering of the numerous spectators, the bottle being successfully broken, and the vessel named by Mrs. Benney. This steamer is to carry passengers on the River Fal, in conjunction with the *New Resolute*. She is 86 ft. 6 in. long, 16 ft. 6 in. broad, 7 ft. 11 in. deep, and will have compound surface condensing engines, to work at 90 lbs. steam pressure. She is built of steel throughout, and her after cabin is raised above the deck, which enables a more comfortable and better ventilated saloon to be provided, and also gives an elevated promenade deck, from which the splendid scenery of the river will be easily viewed. The steamer is berthed alongside the builder's wharf, and her completion ready for passenger traffic will be carried out with all possible dispatch.

Condor.—On June 2nd there was launched by Messrs. Joseph L. Thompson & Sons, at Sunderland, a steel screw-steamer built to the order of the New York and Pacific Steamship Co., Limited. The vessel is of the spar-deck type, and is of the following dimensions:—Length, 334 ft.; breadth, extreme, 42 ft. 6 in.; depth, moulded, 28 ft. 6 in.; and has been built under special survey for Lloyd's highest classification. The engines, by Mr. John Dickinson, of Palmer's Hill Engine Works, are of the triple-expansion type, having cylinders 24½ in., 40 in., and 66 in. diameter, with a stroke of 45 in. The vessel was named the *Condor*.

Silverdale.—On June 2nd, a steel schooner-rigged steamer of 2,705 tons was launched at Sunderland, owned by Messrs. Milburn Bros., of Newcastle.

Erivan.—On June 6th Palmer's Shipbuilding and Iron Co. Limited, launched from their Howden yard a steel screw-steamer of the following dimensions:—Length, 285 ft.; breadth, 38 ft. 6 in.; depth 27 ft.; with a carrying capacity of 3,300 tons. This vessel has been built to the order of the Societe Anonyme Pour l'Importation des Hiutes de Grassage, of Antwerp, and was built under the supervision of Mr. G. Schaeffer, of Newcastle, and Captain Muller, of Antwerp. She will receive the highest class at Bureau Veritas on completion. The vessel is of the spar-deck type, with bridge amidships for the accommodation of captain and officers, topgallant forecastle for crew, and house aft for the engineers. The ship is specially adapted for the carrying of oil in bulk, having five oil-tight compartments divided with a longitudinal bulkhead, and three large coffer dams. The equipment includes steam windlass, steam winches, and patent hand and steam-gearing amidships, and the electric light. The engines are also supplied by the Palmer Co., and are of the triple-expansion type, with cylinders 22½ in., 36½ in. and 60 in. by 42 in. stroke, with two large single-ended boilers, having a working pressure of 160 lbs. to the square inch. As the vessel was leaving the ways she was christened by Mrs. A. G. Schaeffer, of Newcastle, and named *Erivan*.

Marie.—On June 10th there was launched by Messrs. William Dobson & Co., at Low Walker-on-Tyne, a screw-steamer, constructed with clipper stem, and fitted for the conveyance of passengers and cargo. She has been built for a Russian company, and her dimensions are:—Length, 253 ft.; breadth, 32 ft. The machinery has been made by the Wallsend Slipway and Engineering Co., Limited. The vessel was named *Marie*.

Demetrio S. Schilizzi.—On Wednesday, June 14th, Messrs. Wm. Gray & Co., Limited, launched the fine screw steamer *Demetrio S. Schilizzi*. This vessel has been built to the order of Messrs. Foscolo, Mango & Co., of Piræus, Greece, under the personal superintendence of Mr. M. D. Foscolo, one of the owners. She will take Lloyd's highest class, but is in some important respects of heavier scantlings than the rules require, particularly under and about the boiler room. She is of the partial awning deck type, with hood and deck-house aft on the raised quarter-deck. The saloon and cabins are amidships, the engineers' berths aft of the engine-room, and the crew's quarters forward, all under the awning deck. The hull is built with web frames, and a cellular double bottom is fitted throughout, excepting that under the boilers there will be no water ballast carried. All arrangements and appliances of the best description have been adopted, including large hatchways, powerful steam winches, steam and screw steering gears, multitubular donkey boiler, patent direct steam capstan windlass, by Emerson, Walker & Co., telescoping masts, boats on beams overhead, &c., and engines of 22 in., 36 in. and 59 in. diameter, by 39 in. stroke, and 160 lbs. pressure by Messrs. Blair & Co., Limited, of Stockton. The dimensions of the vessel are:—Length over all, 297 ft.; breadth, 39 ft.; depth, 19 ft. 2½ in. The ceremony of naming the *Demetrio S. Schilizzi* was gracefully performed by Miss Appleby, of Greatham.

Margarita.—On June 14th Messrs. Wm. Pickersgill & Sons launched at Southwick a steel three-masted barquentine—Length, 172 ft.; breadth, 30 ft.; depth, 14 ft. 5 in.; to carry about 830 tons. She has been built to the order of Messrs. S. C. and F. H. Chambers, of Liverpool, and was named *Margarita*.

Thomas Wayman.—On June 14th a new steel screw-steamer was launched from the shipbuilding yard of Messrs. John Readhead & Sons, West Docks, South Shields. The vessel is 280 ft. long, 38 ft. broad, and 22 ft. deep moulded, her deadweight capacity being 3,400 tons, and she is classed 100 A1 at Lloyd's. She is of the improved well-deck type, and is fitted with all the latest appliances for rapid discharging of cargo. The engines, also built by Messrs. Readhead, are on the triple-expansion principle, having cylinders of 21 in., 35 in., and 57 in. by 39 in. stroke, and the working pressure being 160 lbs. Steam is supplied by two steel boilers, in each of which are three patent furnaces. The steamer has been built to the order of the Charlton Steam Shipping Co., Limited, Newcastle, of which Messrs. Charton, M'Callum & Co. are the managers, and as she left the ways she was named the *Thomas Wayman*, after the chairman of the company, the christening ceremony being performed by Mrs. M'Callum.

Gena.—On June 15th Messrs. T. Turnbull & Son, Whitehall, Whitby, launched a new screw-steamer, built of steel. Her length over all is 321 ft. 9 in.; length between perpendiculars, 311 ft.; breadth, extreme, 40 ft. 6 in.; depth to top of flooring, 21 ft. 11 in., fitted with patent direct steam windlass, by Emerson, Walker & Co. She is classed 100 A1 at Lloyd's. Her engines are by Messrs. Blair & Co., Stockton, and of 236 H.P. She was named the *Gena*.

Kalman Kiraly.—On June 15th Messrs. Wigham Richardson & Co. launched at Newcastle-on-Tyne a steel screw-steamer which they are building to the order of the Royal Hungarian Sea Navigation Co. Adria, Limited, of Fiume and Budapest. The vessel is 285 ft. in length and 38 ft. beam; and the engines are of the triple-expansion type. She was named the *Kalman Kiraly*.

Lucigen.—On June 15th the tank steamer *Lucigen* was launched at the Walker shipyard of Messrs. W. G. Armstrong, Mitchell & Co. The *Lucigen* is capable of carrying about 5,000 tons. She has been built to the order of Messrs. H. E. Moss & Co., of Liverpool, managers of the Lucigen Steamship Co., who were represented at the launch by Mr. E. A. Cohan. After the launch the vessel was taken to the works of the Wallsend Slipway and Engineering Co. to receive her machinery.

Oliva.—On June 15th there was launched from the shipbuilding yard of Messrs. W. Harkess & Son, Middlesbro'-on-Tees, a handsomely modelled steel and iron screw steamer, specially designed and built for Messrs. J. Burnett & Sons, Mincing Lane, London, for their line of steamers which run from London to Paris, and for this purpose she has been constructed with masts and funnel made to lower by special machinery, so that she can pass under the low bridges which cross the river Seine. The dimensions are as follows:—Length, ex. 182 ft. 1 in.; breadth moulded, 26 ft. 6 in.; depth moulded, 12 ft. 9 in. The vessel has a flush deck and raised poop, and forecastle, which contain the accommodation for passengers, officers and crew. She is fitted throughout with the most modern machinery, including direct steam windlass and 3 steam winches by Clarke, Chapman & Co., Gateshead. Steam and hand steering gear by Alley & McLellan, Glasgow. The engines are by Messrs. Westgarth, English & Co., Middlesbro', having three cylinders, 15½ in. by 25 in., 41 in. diameter, by 27 in. stroke. A large boiler which together with the donkey boiler and all deck machinery works at a pressure of 160 lbs. per square inch. The vessel will carry a cargo of about 680 tons on a mean draught of 11 ft. and has been built greatly in excess of Lloyd's requirements for their 100 A1 class. On leaving the ways she was named *Oliva* by Miss Burnett, daughter of the owner.

Volute.—On Thursday, June 15th, Messrs. Wm. Gray & Co., Limited, launched the splendid steel screw-steamer *Volute*, the fifth of the steamers they are building for Messrs. Samuel & Co., of 31, Houndsditch, London, for the bulk petroleum trade to the East, through the Suez Canal. The *Volute* is a sister ship to the *Elax*, which has just recently made a very successful start on her career. She will take Lloyd's highest class, and is built on the awning or shade deck type. Her dimensions are as follows:—Length, over all, 358 ft.; breadth, extreme, 45 ft. 6 in.; depth, 28 ft. 6 in. The engine and boiler rooms are in the after-part of the vessel, and underneath them there is a double bottom for water ballast. The forward and after peaks are also fitted for water ballast for trimming purposes. Forward of the boiler-room there are nine strong transverse bulkheads, and also a very strong fore-and-aft bulkhead from the keel to the main deck. Altogether there are thirteen separate oil tanks. These oil tanks are separated from the boiler-room and bunkers aft, and from the cargo hold forward by large cofferdams, which are carried to the shade-deck in each case, and which can be filled with water when required, and they are under the control of special and separate pumps placed on deck. Expansion trunks are carried up from the middle of each oil compartment to allow the oil to rise and fall with the varying temperatures. These trunks, in conjunction with large hatchways, will be used for loading general cargoes. Two powerful pumps are fitted in the pump-room amidships for discharging the oil cargo. They are capable of pumping out the entire cargo of over 4,900 tons of oil in 12 hours, and will also pump water from the sea to fill the oil tanks when required for ballast. When the oil cargo has been discharged, the tanks will be cleansed and adapted to receive general cargo by special means provided. A powerful fan will be fitted capable of exhausting the air from each tank in ten minutes, in order to thoroughly ventilate the compartments when filled with general cargo, the exhaust air being delivered through a cowl a good way above deck. The vessel will be fitted throughout with an electric light installation by Messrs. J. H. Holmes & Co., Newcastle-on-Tyne, lighting the whole of the cabin, engine and boiler-room, galley, chart and wheel-house, binnacle and telegraphs, &c. In addition she will have a 20 in. projector, and the necessary lighting for navigating the Suez Canal at night. In order that all parts of the ship may be thoroughly examined after cargo has been discharged, she will be provided with a number of portable lamps. The cabin, forecastle, and petty officers' rooms will be heated by steam, so as to avoid any risk of fire. The accommodation of captain, officers, and the saloon are under the shade-deck. The engineers' rooms in a large house on deck aft, and the crew forward. A patent steam steering gear will be fitted amidships, and screw gear aft, patent steam windlass, by Emerson, Walker & Co., two donkey boilers, patent stockless anchors, and in addition to all the necessary fittings and outfit for the oil trade, there will be a complete outfit for working general cargoes, including six steam winches. Three masts will be fitted and neatly rigged, and awnings all fore and aft for the Eastern climate. Great care has been taken to ensure strong and sound work. The rivetting is closely spaced in shell plating, decks, and bulkheads, and in order to reduce as far as possible the number of joints in way of the oil tanks, most of the shell-plates being nearly 30 ft. long. The vessel will be fitted with a very powerful set of triple-expansion engines of the well-known type manufactured by the Central Marine Engine Works of Wm. Gray & Co., Limited. The cylinders will be 26 in., 42 in. and 70 in. in diameter respectively, and of 45 in. stroke. An extra large amount of boiler-power also is provided in the shape of three large single-ended boilers, working at a pressure of 160 lbs. per square inch. Increased safety is ensured by placing two of the boilers with their backs towards the coffer dam, removing the heat of the stokehold a considerable distance from the bulkheads. The engines are capable of driving the ship at a high rate of speed when loaded, and are furnished with all the latest improvements. The engine-room also contains one of Mudd's new patent feedwater evaporators, which is designed on a plan greatly facilitating cleaning and examination. The vessel and machinery have been built under the superintendence of Messrs. Flannery, Baggallay & Johnson, of London. The ceremony of naming the *Volute* was gracefully performed by Mrs. George Jones, of West Hartlepool.

Whaleback Steamer.—On June 15th was launched from the yard of William Doxford & Sons, Limited, of Sunderland, a whaleback steamer—No. 218—which has been built on foreign account, through Messrs. W. Johnston & Co., Limited, of Liverpool. This is the first vessel built in Great Britain of the American whaleback type under the "McDougall" patents. Her principal dimensions are 320 ft. by 38 ft. 2 in. by 26 ft., load draught 19 ft., and she is intended to carry about 3,500 tons. She is fitted with triple-expansion engines, also by Messrs. Doxford, 23 in., 37 in., and 60 in. by 42 in. stroke, and large single-ended boilers. The hull, generally, is of the Whaleback design, and above this are erected seven towers, forming supports on which are carried the winches, derricks, cabins, &c., the two towers over the machinery space being much larger than the others, and upon them and around the engine and

boiler openings are built the whole of the cabins, which are 7 ft. above the hull proper, and are supported at the sides by large ventilating tubes, which are carried down through the decks and into the engine and boiler room. The vessel has nine cargo hatchways, and as usual in whaleback steamers, these are built without coamings and are fitted with watertight iron covers, which are bolted down, leaving the whole of the upper portion of the vessel clear of obstructions other than the towers already referred to.

LAUNCHES—Scotch.

La Biguesa.—On May 29th the Grangemouth Dockyard Co. successfully launched from their shipbuilding yard at Grangemouth, a handsomely-modelled steel sailing vessel, specially designed for carrying crude petroleum in bulk from Philadelphia to Spain. She has been built to the order of Messrs. Babe & Co., of Vigo, Spain, and is intended to carry oil for their own factories. On taking the water she was gracefully named the *La Biguesa* by Miss Jeannie Miller, Grangemouth. The *La Biguesa*, which was launched completely rigged ready for sea, is divided into six oil-tight compartments for petroleum, with a coffer dam at each end of the vessel effectually shutting the oil off from the rest of the vessel. She has also two small holds, one forward and one aft, and is fitted with a powerful set of Worthington pumps, capable of discharging the whole of the cargo of over 900 tons in 24 hours; is lighted throughout with the electric light; has patent windlass by Emerson, Walker & Co., screw steering gear aft, handsome accommodation for captain and officers in poop and for crew in topgallant forecastle. She s classed 100 A1 at Lloyd's under their special survey for the carriage of petroleum in bulk: and no expense has been spared to provide for the safety and efficiency of the vessel, taking into consideration the dangerous nature of the cargo. The *La Biguesa* is one of the first sailing vessels built specially for this trade.

Rio Purus.—On May 29th Messrs. Murdoch & Murray launched from their yard at Port-Glasgow a steel twin-screw steamer for passenger service on the river Amazon of the following dimensions, viz.:—170 ft. by 27 ft. sponsoned to 30 ft. at deck by 9 ft. moulded, classed at Lloyd's for river purposes. The lower deck is fitted for carrying cattle, and also fitted with engineers' rooms, store rooms, &c. The promenade deck has large deck-house fitted for passengers, with iron folding berths, shower baths, &c., and extra care and attention has been given to the thorough ventilation of passenger accommodation and holds. The whole of the wood work is of best selected teak. The vessel is fitted throughout with electric light. As the vessel left the ways she was named *Rio Purus*, and was taken in tow for Glasgow, where her engines and boiler will be fitted on board by Messrs. David Rowan & Son. The *Rio Purus* is a sister ship to the *Botelho*, lately built for the same owners, with several important improvements.

Hildebrand.—On May 30th a steel screw steamer, named the *Hildebrand*, was launched by Messrs. Hall, Russell & Co., at Aberdeen. Her dimensions were as follows:—Length, 271 ft.; breadth, 36 ft. 6 in.; depth, 25 ft.; tonnage, 1,950 gross; triple-expansion engines of 190 N.H.P. She has been built to the order of the Booth Steamship Co., Limited, Liverpool, and is to be engaged in the Liverpool, North Brazil and New York trade.

Catalina.—On May 31st Messrs. Charles Connell & Co. launched from their building yard at Scotstoun a steel screw-steamer for Spanish owners of the following dimensions:—400 ft. by 48 ft. by 31 ft., and measuring about 4,950 tons. She is built to the highest class in Lloyd's, and is fitted up in a very handsome manner for a large number of both first and second-class passengers, also for a arge number of emigrants. The engines are triple-expansion, having cylinders 29 in., 46 in., 74 in., by 45 in. stroke, and are being supplied by Messrs. Dunsmuir & Jackson, Govan. As she left the ways she was named *Catalina* in the customary manner by the wife of the superintending engineer, Mr. Ceroos. The vessel has been built under the superintendence of Captain Abrisqueta.

Glen Rosa.—On May 31st Messrs. James & George Thomson, Limited, launched from their yard at Clydebank the paddle-steamer *Glen Rosa*, the second of two vessels built by them for the Glasgow and South-Western Railway Co She is a duplicate of the *Minerva*, launched earlier in the month, and both vessels have been specially constructed for more extended excursions down the Channel, and also for winter service. The *Glen Rosa* is intended for the Arran route. She has a length of 200 ft., and a gross tonnage of 350 tons, and is expected to attain a high rate of speed The vessel was named by Miss Guthrie, daughter of Mr. D. Guthrie, deputy-chairman of the Glasgow and South-Western Railway Co.

L. P. Holmblad.—On May 31st Messrs. Lobnitz & Co. launched from their yard at Renfrew a steel screw steamer to carry 3,000 tons for the United Steamship Co., of Copenhagen. The vessel will be supplied by the builders with triple-expansion engines of 1,100 H.P. She is specially arranged for the trade from the north of Europe, Mediterranean, and Black Sea, and has all the most recent appliances for loading and discharging cargo, steam steering gear, &c. The vessel was named *L. P. Holmblad* by Miss Koch, of Copenhagen, and the owners were represented by Captain Ingelslev.

Marie Louise.—On Thursday, June 1st, Messrs. Cumming & Ellis launched from their shipyard at Inverkeithing, a steel barquentine to carry 600 tons deadweight, and of the following dimensions, viz.:—140 ft. by 27 ft. by 12 ft. 2 in. moulded. This vessel has been built to the 100 A1 class at Lloyd's special survey, and to Board of Trade requirements in all respects. She is intended for trade on the South American coast, and all her deck and other arrangements are suited to this trade. She is barquentine-rigged, the lower masts, bowsprit, yards, &c., being of steel. All the rigging throughout is of steel wire in accordance with Lloyd's requirements. The captain and officers are berthed in a spacious deckhouse aft, neatly and tastefully fitted up in every way, the crew being in another deckhouse forward instead of in the forecastle. All the deck fittings about the vessel are of the most modern description and by well-known makers, and she will be very completely fitted out for the trade in which she will be engaged. As the vessel left the ways she was gracefully christened the *Marie Louise* by Mrs. Mecklenburg, wife of Captain Mecklenburg, who commands the ship on completion. After the launch the visitors adjourned to the builders' model-room, where the usual toasts customary on such occasions were given and responded to.

Otterburn.—On June 1st Messrs. Barclay, Curle & Co., Limited, Whiteinch, launched a fine steel sailing four-masted barque for the Burn Line (Messrs. Robert Shankland & Co., Greenock). The vessel is intended for general trade, will be furnished with complete East India outfit, and will measure about 2,600 tons gross. On moving on the ways the vessel was named the *Otterburn* by Miss Isa Shankland, daughter of Mr Dugald Shankland, managing owner.

Bittern, Cygnet and Holycon.—On June 5th the *Bittern Cygnet* and *Holycon*, three steel screw-trawlers of about 140 tons, built for the Grimsby Ice Co., were launched by Messrs. Mackie & Thomson, Govan. The vessels are each 97 ft. 6 in. long, 20 ft. 6 in. broad, and 11 ft. 7 in. moulded, deep. Triple-expansion engines will be supplied by Messrs. Muir & Houston.

Serena.—On June 5th a three-masted barque, named the *Serena*, which has been built to the order of Messrs. Macdonald, Adams & Co., Greenock, was launched from the Kingston Shipbuilding Yard of Messrs. Russell & Co. The *Serena* is a vessel of 1,530 tons nett register, and has a carrying capacity of 2,720 tons.

Almora.—On June 6th Messrs. William Hamilton & Co., Port-Glasgow, launched from their Castle Yard a steel sailing barque of 3,150 tons deadweight capacity, named the *Almora*, by Miss Blair, 52, Eldon Street, Greenock. The vessel is completely fitted with all the best modern appliances, including Messrs. M'Onie's windlass, and the same firm's patent halyard winches. The *Almora* was built to the order of Messrs. W. & J. Crawford, Greenock, and was superintended during construction by Mr. Alexander Adams, shipwright surveyor.

Fairy Queen.—On June 6th from the yard of Mr. John Gilmour, Irvine, there was launched a steel screw steamer for passenger traffic on the Forth and Clyde Canal, between Kirkintilloch and Craigmarloch. She is designed to accommodate about 200 passengers, and measures 66 ft. by 14 ft. by 7 ft. The vessel has been built to the order of Messrs. James Aitken & Co., Limited, Kirkintilloch, and was named the *Fairy Queen*.

Maria.—On June 6th Messrs. Napier, Shanks & Bell, Yoker, launched the steam yacht *Maria*, built to the order of Mr.

Ninian B. Stewart, Wemyss Bay, from designs by Mr. St. Clare J. Byrne, of Liverpool. The *Maria* has been built to replace the s.y. *May*, of 766 tons, sold by Mr. Stewart to an American gentleman. Her dimensions are :—Length on load water line, 210 ft.; breadth, 28 ft. 2 in.; depth, 19 ft.; and about 857 tons O.M. The internal arrangements of saloons and cabins are something similar to the *May's*. She is schooner rigged with square yards on foremast. Two large houses are constructed on deck, framed and plated in steel and panelled in polished teak, and fitted up internally in hard wood, French polished, equal to main saloons. Each of the deck-houses form a companion-way to the respective ends of the vessel, while on starboard side, in 'tween decks, is a passage-way between the dining and the drawing room. Thus avoiding the necessity of having to go on deck in bad weather. The dining saloon, which is situated forward of the engine space, is a very large, airy compartment extending the width of the vessel, and is fitted and furnished in oak, French polished. At the fore end of this saloon, on each side of the passage, is the owner's suite of rooms, each of which is framed in light oak and panelled in bird's-eye maple, the furniture being in walnut. The drawing-room, placed at the after end of the engine spaces, is similar in size and arrangement to the dining saloon, but the walls are in polished walnut. Abaft of the drawing-room are state-rooms for guests, fitted and furnished similar to the forward rooms. The captain and officers are berthed forward of the owner's quarters, in rooms branching off a well-apportioned mess-room, suitably framed and panelled in polished pine; while the crew are housed in a good-sized forecastle. The plumber work and sanitary arrangements are of the most complete description, comprising Downton pump, w.c., patent lavatories, enamelled copper baths, hot and cold water service pipes, &c. The upholstery likewise will be very handsome, and should present a fine appearance when finished. The vessel throughout will be fitted with a complete installation of electric light, and in addition supplementary lamps will be supplied to all the rooms. A handsome tiled fireplace is placed in each saloon, and electric bells are fitted throughout the yacht. The deck gear consists of steam windlass, steam steering gear (to steer from bridge and aft), and hand capstan aft: while the davits will carry four boats and a steam launch. Awnings will be provided right fore and aft and over bridge. The machinery will be supplied by Messrs. David Rowan & Son, Glasgow, and is of power enough to maintain a speed of 13 knots at sea. The hull and machinery has been constructed to Lloyd's 100 A1 class. The vessel was named by Mrs. N. B. Stewart, jun., and amongst those present were Mr. and Mrs. Brittain, Algeria; Professor and Mrs. Biles, Mr. Sharp, Mr. Young, Miss Wallace and friends, Mrs. Stevenson, Captain A. R. Brown, Japanese Consul, Mr. St. Clare Byrne, Mr. George Weir.

Queen Margaret.—On June 6th Messrs. A. M'Millan & Son, Limited, Dumbarton, launched a handsome four-masted steel sailing vessel of 2,150 tons gross register, which has been built to the order of Messrs. John Black & Co., Glasgow. She has been fitted with open topgallant forecastle, three deckhouses, and full poop, and is outfitted in the most substantial manner with all modern appliances. The ceremony of naming the ship *Queen Margaret* was performed by Mrs. Black, 16 Park Terrace, Glasgow. Captain D. F. Faulkner takes command after completion.

Dowanhill.—On June 13th Messrs. Russell & Co. launched at Port Glasgow the four-masted barque *Dowanhill*, built to the order of J. R. Dixon & Co., Glasgow. The vessel is of 2,200 tons register and 3,600 tons carrying capacity. Her dimensions are 283 ft. by 40 ft. by 24 ft.

Hopper Barge.—On June 13th Messrs. Fleming & Ferguson, shipbuilders, Paisley, launched a twin-screw hopper barge, constructed to the order of the Clyde Trustees. Her dimensions are :—205 ft., 35 ft., and 15 ft. 6 in., and she has a hopper capacity of 1,200 tons. She will be fitted with two sets of triple-expansion engines, to indicate 1,200 H.P.

Pholas.—On June 13th Messrs. Wm. Simons & Co., Renfrew, launched from their yard the hopper dredger *Pholas*, which they constructed to the order of the Crown agents for the Colonies. It was constructed to the designs and under the direction of Messrs. Coode, Son & Matthews, Civil Engineers, Westminster. Mr. Wilson Wingate, naval architect, superintended its construction on their behalf. It will be employed deepening the port of St. John's, Antigua, to a depth of 32 ft. under water level. The hopper compartments have a capacity for over 400 tons of dredgings. The dredging wheel gear is made chiefly of steel, and friction gear is provided to prevent undue strains coming on the dredging machinery. It is provided with a set of triple-expansion engines of 550 I.H.P. and two steel boilers of 160 working pressure, also steam-steering and steam-starting and reversing gear. The cabins for the officers and crew are well adapted for a warm climate. The *Pholas* is the fifth dredging steamer the builders have supplied to the Crown Agents for the Colonies. The vessel was launched complete ready for work with the buckets on the bucket ladder, and after being moored in Renfrew Harbour, a very successful trial of the engines, dredging and deck machinery took place.

Borgnis Desbores.—On June 14th Messrs. Scott & Co., Greenock, launched a steel passenger steamer of 200 tons register to the order of Messrs. Deves & Chaumet, Bordeaux, for service on the river Senegal. Dimensions :—Length, 145 ft.; breadth, 22 ft.; depth, 8 ft. The new steamer is named *Borgnis Desbores* after a French general. She is to be supplied with compound diagonal engines, 400 I.H.P., with a working pressure of 106 lb., the cylinders being 18 in. and 38 in. respectively, with a piston stroke of 42 in. She will be fitted with two boilers and two funnels, and all the frames and shell-plates under water are galvanised.

Saturnus.—On June 14th a large screw steamer named *The Saturnus* was launched from the shipbuilding yard of Messrs. John Scott & Co., Kinghorn. Although a strong breeze was blowing from the east the launch was one of the most successful that has taken place from the yard. The vessel immediately proceeded up the Firth on a trial trip. She is elegantly fitted out and has all the latest improvements.

Bermuda.—On June 15th Messrs. Russell & Co. launched from their Greenock yard a four-masted awning-decked sailing ship named *Bermuda*, for Messrs. Peter Denniston & Co., Glasgow. Dimensions :—Length, 283 ft.; breadth, 43 ft.; depth, 23 ft.; to awning-deck, 30 ft.: and of 4,100 tons deadweight carrying capacity. This is the first built on the awning-deck style. She is fitted with deep hold water ballast tanks, containing sufficient ballast for sea-going purposes, and she has been specially designed for carrying large measurement cargoes, combined with safety at sea, fitted with Emerson, Walker & Co.'s patent capstan windlass. The *Bermuda* is intended for the general carrying trade, and will be in command of Captain Khon, formerly of the ship *Tasmania*. Messrs. Russell & Co. are engaged on another vessel of the same type for Liverpool owners.

Christina.—On June 15th Messrs. S. M'Knight launched at Ayr a steel screw steamer, built to the order of Murphy Brothers, coal merchants, Waterford. Machinery to ensure a speed of 12 knots loaded, will be supplied by Messrs. Muir & Houston, engineers, Glasgow. Principal dimensions :—Length, between perpendiculars, 165 ft.; breadth, 26 ft.; depth, 13½ ft.; cylinders, 23 in. and 46 in. diameter by 33 in. stroke; boiler, 15 ft. diameter by 10 ft. 6 in. long, 120 lbs. pressure; class, Lloyd's 100 A1, under special survey. The vessel was named the *Christina*.

Columba.—On June 15th there was launched from the yard of Messrs. Hawthorns & Co., Leith, a finely modelled iron screw trawler, built to the order of Mr. T. Devlin, jun., Newhaven. Dimensions :—100 ft. by 20 ft. by 11 ft. 3 in., moulded, class 100 A1 Lloyd's. She will be fitted by the builders with compound surface-condensing engines, 17 in. and 34 in. diameter by 22 in. stroke. On leaving the ways she was christened *Columba* by Miss Devlin. She is expected to attain a speed of 11 knots, and is the seventh vessel built by Messrs. Hawthorns for the same owner.

Ebenezer.—On June 15th Messrs. Marrs Bros., Leith, launched from their upper yard a finely modelled steam line fishing boat, built of wood under Lloyd's special survey to the order of Messrs. W. H. Dodds & Co., Aberdeen. She measures 8 ft. between perpendiculars, 19 ft. in breadth, and 10 ft. in depth. Her machinery will be fitted in by Messrs Clyne, Mitchell & Co. The vessel was named the *Ebenezer* by Mrs. Dodds, wife of the owner.

Sea Gull.—On June 16th Messrs. John Fullerton & Co. launched at Paisley a steel screw steamer of about 150 tons for Messrs. R. & W. Paul, Ipswich, for their coasting and carrying trade between that port and London. Compound engines of 140 H.P. are being supplied by Messrs. Ross & Duncan, Govan. The steamer was named the *Sea Gull*.

Fairy.—On June 17th Mr. D. M. Cumming, Blackhill Dock, launched from his yard a steel paddle steamer 61 ft. 6 in. by 13 ft. by 6 ft. 6 in. moulded, built to the order of the Town Council of Inveraray for their passenger traffic between Inveraray and St. Catherine's. The engines, which are diagonal compound surface condensing, are being supplied by Messrs. Lees, Anderson & Co. During the construction of the vessel she was superintended by Mr. James Donaldson, marine surveyor, Glasgow. On leaving the ways she was named *Fairy* by Miss Cumming

Empress.—On June 22nd Messrs. John Reid & Co., Limited, launched from their yard at Whiteinch, a steel paddle steamer for the Goole and Hull Steam Packet Co., the machinery of which is being supplied and fitted by Messrs. Kincaid & Co., Limited, Greenock. This vessel, which was named the *Empress*, has been built under the supervision of Mr. Robert Carson, consulting engineer, Hull.

Kipper.—On June 22nd the 17-foot *Kipper*, built by Mr. John Ninian, Largs, from the designs of Mr. W. Fife, junr., for Mr. Arthur Connel, Partick, was successfully launched. She is planked of mahogany throughout.

Thetis.—On June 22nd there was launched from the yard of Messrs. Arch. M'Millan & Son, Limited, Dumbarton, a steel barquentine, built to order of the Falkland Islands Co., of London, and specially designed for them by Mr. Josiah M'Gregor, also of London. The vessel's dimensions are 133 ft. by 25 ft. 6 in. by 15 ft. 6 in., and she has been built with a view to the peculiar features of the Falkland Islands' navigation, which is intricate and difficult, especially as the islands are situated in a very stormy region. Her decks fore and aft are of teak, and she is fitted with a double bottom, divided into four ballast tanks, which can be speedily emptied by a powerful Downton pump, specially constructed for the purpose. All her rigging and fittings are arranged in accordance with the newest and most improved ideas. As her lines are very fine, and she spreads an unusually large area of canvas, she is expected to be very fast and weatherly, and thus fulfil the principal object her designer had in view. The saloon and cabins, which are adapted for a limited number of passengers, are handsomely fitted in teak, oak, and Nyassa wood, and upholstered in dark green and terra-cotta. She will be commanded on the maiden voyage by Captain M. Patmore, who has superintended her building. As the ship left the ways she was christened *Thetis* by Mrs. Patmore. There were present at the launch Mr. Frederick Cobb, the managing director of the Falkland Islands Co.; Mr. Rhodes Cobb, another of the board; Mr. Josiah M'Gregor, M.I.M.A. and M.I.N.A., the designer; and various persons interested in the ship and their friends.

Thaber.—Messrs. Fife & Son, Fairlie, have lately completed and launched a new 23 ft. racing boat for Mr. P. M. Coats, Paisley. She has been christened the *Thaber*. A "water wagtail," a class of open boat very popular in Kingston waters, has been built for a Dublin yachtsman by Mr. J. Ninian, Largs, and will be despatched for Dublin Bay.

LAUNCHES—AMERICAN.

Massachusetts.—On June 10th there was launched from Messrs. Cramp's yard at Philadelphia, the coast line turret battleship *Massachusetts*, which is 348 ft. long and 69 ft. 3 in. beam, and at 24 ft. draught displaces 10,231 tons. She is heavily armoured, the belt being 18 in., while the main turrets have 17 in. armour, and the smaller turrets 8 in. to 6 in. armour. The armament consists of four 13-in., eight 8-in., and four 6-in. breechloading guns, with sixteen 6-pounder and four 1-pounder quick-firing guns, in addition to several machine guns and torpedo launching cars. The vessel in some respects approximates to our second-class battleships *Centurion* and *Barfleur*, although these latter have heavier big guns, although not so many smaller weapons. The British ships, too, have much greater power and two knots more speed, the engines of the *Massachusetts* being specified to indicate 9,000 H.P., and give 16 knots speed. The cost is about the same as the *Centurion*, just over £600,000.

Pilgrim.—On June 12th the steel sloop racing yacht *Pilgrim*, designed by Messrs. Stewart & Binney, as the America Cup defender, was launched at Wilmington, on the Delaware River. She has been towed to Brooklyn to have her fins placed, and will then go to Boston for outfitting. The *Pilgrim* is 120 ft. long, 23 ft. beam, 5 ft. in depth, with 17 ft. fins. The total draught is 22 ft. She will have 20 tons of lead ballast, and will carry more canvas than the yacht *Volunteer*, her model being a radical departure from accepted theories. She will have no keel, but three fins—one a small centre-board forward; the main fin, under the centre of the hull, being a steel plate 17 ft. deep, covering half the length of the hull; and a small after-fin, forming a stay for the rudder under the overhanging stern end

Chippawa.—There was recently launched from the yard of the Hamilton Bridge Co., Hamilton, Ont., the paddle steamer *Chippawa*, built for the Niagara Navigation Co., for service between Toronto and Niagara River. The vessel is 311 ft. long and 36 ft. beam. Motive power is supplied by a set of engines supplied by Messrs. W. & A. Fletcher, Hoboken, N.J., U.S.A.

City of Collingwood—There was recently launched at Owen Sound, Ont., the wooden steamer *City of Collingwood*, built for the North Shore Navigation Co., Kingston, Ont. The vessel is 215 ft. long, 34 ft. beam, and 13 ft. 4 in. deep. Motive power is supplied by a set of triple-expansion engines of 1,000 H.P.

L. R. Doty.—There was recently launched from the yard of Messrs. F. W. Wheeler & Co., West Bay City, Michigan, U.S.A., the wooden cargo steamer *L. R. Doty*. The vessel is 290 ft. long, 41 ft. beam, and 23 ft. deep. Motive power is supplied by a set of triple-expansion engines having cylinders 20 in., 32½ in., and 55 in. diameter, by 42 in. stroke.

LAUNCHES—FRENCH.

Lansquenet.—On May 18th the sea-going torpedo boat *Lansquenet* was launched from the yard of M. P. Oriolle, at Nantes, France, for the French Government. The vessel is 165 ft. 3 in. long, 15 ft. 8 in. beam, with a draught of 4 ft. 2 in., and a displacement of 638 tons. Motive power is supplied by two sets of triple-expansion engines of 2,800 H.P.

Gustave-Zede.—On June 1st there was launched from the Mourillon yards at Toulon the submarine vessel *Gustave-Zede*, built for the French Navy. The vessel, which is a kind of submarine torpedo boat, will when completed be put through a series of tests.

Chevalier.—On June 15th the torpedo boat *Chevalier* was aunched at Havre ofr the French Government. The vessel is 144 ft. 4 in. long, 14 ft. 9 in. beam, with a displacement of 123 tons. Motive will be supplied by two sets of triple-expansion engines, by which a speed of 24½ knots is expected to be attained.

LAUNCHES—GERMAN.

Faygeta.—On May 15th a new steel screw steamer was launched from the yard of the Flensburg Shipbuilding Co., the dimensions are: 243 ft. by 34 ft. by 12 ft. 2 in., and will be fitted with triple-expansion engines of 500 H.P. On leaving the ways she was christened *Faygeta*, by Miss Kate Molzen, daughter of the corresponding owner.

Gefion.—On May 31st Messrs. Schichau launched from their yard at Elbing, near Dantzic, Germany, the corvette cruiser *Gefion*, built for the German Navy. The vessel, which has been constructed of Krupp steel, is 344 ft. 5 in. long, 42 ft. 7 in. beam, and 25 ft. 6 in. deep, with a displacement of 3,900 tons. Motive power will be supplied by two sets of triple-expansion engines indicating collectively 9,800 H.P. The armament of the vessel will be composed solely of quick-firing guns.

H. A. Nolze.—On June 10th there was launched from the yard of the Flensburg Shipbuilding Co., Germany, the steamer *H. A. Nolze*, built for the Neptune Steamship Co. The vessel is 188 ft. long, 26 ft. beam, and 17 ft. deep. Motive power will be supplied by a set of triple-expansion engines of 350 H.P.

LAUNCHES—DANISH.

Princess Marie.—On May 18th there was launched from the yard of the Elsinore Iron Shipbuilding and Engineering Co., Elsinore, Denmark, the steel sailing ship *Princess Marie*, built for Mr. P. R. Wüstler, Fano. The vessel is 222 ft. 6 in. long, 36 ft. 6 in. beam, and 21 ft. 9 in. deep.

Danmark.—On June 3rd Messrs. Burmeister & Wain launched from their yard at Copenhagen the steel cargo steamer *Danmark*. The vessel is 284 ft. long, 38 ft. beam, and 20 ft. deep. Motive power will be supplied by a set of triple-expansion engines of 1,000 H.P.

LAUNCH—ITALIAN.

Liguria.—On June 8th Messrs. Gio. Ansaldo & Co. launched from their yard at Sestri Ponente, Italy, the cruiser *Liguria*, built for the Italian Government. The vessel is 262 ft. 4 in. long, 39 ft. 8 in. beam, and 28 ft. 2 in. deep. Motive power will be supplied by triple-expansion engines of 6,500 H.P. The armament will comprise six 152 mm. guns, nine 57 mm. quick-firing Nordenfeldt guns, and four 37 mm. Hotchkiss machine guns.

TRIAL TRIPS.

Johanna.—On May 9th the new screw steamer *Johanna*, built by the Flensburg Shipbuilding Co., made her trial trip. This vessel is built for Mr. H. Schuldt, of Flensburg, and has the following dimensions: 243 ft. by 34 ft. by 17 ft. 2 in. She is a raised quarterdeck boat with double cellular bottom, and specially fitted out for the coal and timber trade. On the trial a large party of shareholders was invited to partake in this trip, and everything went to the greatest satisfaction. The triple-expansion engines, also built by the Flensburg Shipbuilding Co., has 500 H.P., and worked very well. The average speed was 10½ knots.

Suram.—On May 29th the new oil tank steamer *Suram*, owned by Messrs. Bessler, Waechter & Co., of London and Newcastle, and managed by Messrs. Stephens & Mawsom, of the latter port, had a satisfactory trial trip on the measured mile off Whitley. This vessel has been specially built for carrying petroleum oil in bulk by Mr. James Laing, of Sunderland, the triple-expansion engines and boilers being supplied by George Clark, Limited, of the same place. The *Suram* will carry a cargo of about 4,000 tons of oil, with 450 tons of bunkers, upon a draught of about 22 ft.

Hayle.—On May 29th this steamer, built by Messrs. Harvey & Co., Limited, Hayle, Cornwall, for their own trade, had her trial trip. This vessel is an excellent specimen of a modern first-class collier. The vessel carries 880 tons, and is built in excess of Lloyd's requirements for her class, and has a large ballast tank forward. The engines, which have been constructed by Messrs. Harvey & Co., Limited, are on the tri-compound principle, with cylinders 15 in., 28 in., and 38 in., by 30 in. stroke. Steam is supplied at a pressure of 160 lbs. per square inch from one large steel boiler 13 ft. 6 in. diameter by 10 ft. long. The deck machinery is of the most modern description, and includes Clark Chapman's winches, windlass, steam-steering gear is also fitted. The trial showed that a mean speed of 10¾ knots had been attained, the engines working at 102 revolutions per minute, and indicating 576 H.P., everything working smoothly.

Egyptian.—On Wednesday, May 31st, the steam trawler *Egyptian* left the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesbrough, for the customary trial of machinery, &c. The results gave great satisfaction, a speed of 11 knots having been obtained. She has been built for Grimsby account, and is the fifth vessel which these builders have constructed for the same owners. She is designed for the special purpose of trawling in the North Sea; is considerably stronger than Lloyd's requirements, and double rivetted throughout, and is fitted with the most recent improved appliances for this trade, and arrangements for crew, which give very much greater comfort than all previous boats. The principal dimensions are: —Length, 107 ft. 8 in.; beam, 20 ft. 5 in.; depth moulded, 11 ft. 8 in. The engines have been fitted by the North-Eastern Marine Engineering Co., Limited, of Sunderland, the cylinders being 11 in., 17 in., and 28 in., by 21 in. stroke, with a large steel boiler working at 160 lbs. pressure.

Croft.—On Wednesday, May 31st, the twin-screw steamer *Croft*, built and engined by Messrs. David J. Dunlop & Co., Inch Works, Port-Glasgow, went down the Firth of Clyde on her official trial cruise. This steamer has been built to the order of the Royal Niger Co., Chartered & Limited, for their Niger trade, and is the largest of their fleet. The principal dimensions are:—Length, 204 ft.; breadth, 35 ft.; depth, 18 ft. One of the special features in the construction of the vessel is that her light draught when loaded with 40 tons of bunker coal, and 15 tons stores, will not exceed that required for crossing the bars in the river Niger, and the vessel when tested on the above light-load condition, proved to be considerably within the limits of draught guaranteed by the builders She is fitted with twin-screw triple-expansion engines, each engine having cylinders 11 in., 18 in., and 28 in., by 24 in. stroke and has two large boilers with all arrangements for easily keeping steam in the tropics. The engine-room outfit and auxiliary in machinery includes Weir's patent surface feed heaters, Yaryan patent marine evaporator and feed heater and distilling condensers, and large pumping donkeys. After a series of tests on the measured mile on the previous day and four hours' consecutive run for testing the consumption of coal, the quantity used per hour was 1·4 lbs. per I.H.P. The vessel was on the previous day tested for a full speed run on the measured nautical mile, when fully a knot more than the guaranteed speed was attained against both wind and tide. The machinery did the two days working without the slighest hitch, and all the other conditions were thoroughly fulfilled. The steering-gear is Harrison's patent, the engine being placed in the engine-room level with the top platform and well under control of the engineers. After the trial the steamer cruised through the Kyles of Bute, the scenery being much admired by the large company on board. Amongst those present were:—Mr. James A. Croft and Mrs. Croft, Putney, London; Mr. George Miller, Mrs. Miller, Mr. Robert B. Miller, and the Misses Miller, Relvinside, Glasgow; Mrs. Owen Jeffrey Edgar, and Mr. John Edgar, Richmond, London; Mr. Alexander Miller, Putney Heath, London; Mr. Alexander R. Wright, Glasgow; Mr. Charles Gibson, Secretary of the British and African Steam Navigation Co., Glasgow; Mr. W. G. Wilson, Glasgow; Miss Dunlop, and Mr. D. J. Dunlop, Mr. James Wilkie, Superintendent Engineer, British and African Navigation Co.; Mr. Thomas Hodge, Mr. and Mrs. John Wylie, Mr. and Mrs. Remp, Mr. W. A. Robertson, Mr. Marshall, and Mr. Alexander Henderson, Glasgow; The Rev. Matthew Reid, and Mrs. Reid, Greenock; Captain Roberts, who commands the vessel, Mr. James A. Lade, Mr. Archibald Purdon, Mr. H. N. Whitelaw, Mr. J. Sowter, Board of Trade; Major Potberry, and Miss Robilliard, Greenock. After dinner, served by Messrs. Brown & Walker, Glasgow and Greenock, Mr. Dunlop, in proposing "Success to the *Croft*," said, this was the tenth vessel his firm had built for the Royal Niger Co. He coupled the toast with the name of Mr. James A. Croft, after whom the vessel is named, and who has been connected with the river Niger and the development of its trade since 1864. Mr. Croft replied and proposed "The Health of the Builders," which was duly responded to. The company were landed at Gourock Pier at half-past four, after a most successful and enjoyable cruise.

Joaquim.—On June 2nd there sailed from Montrose a splendidly equipped and finely modelled three-masted barquentine of 287 tons, which has been built by the Montrose Shipbuilding and Engineering Co., Limited. She has been built to the order of Messrs. Rettmeyer & Hessenmuller, of Hamburg. Her dimensions are:—139 ft. between perpendiculars, by 26 ft. 6 in. by 10 ft., moulded, to carry 370 tons deadweight on 8 ft. 6 in, mean draught, but can carry 420 tons on Lloyd's freeboard. The officers and crew are berthed in two iron deck-houses, so that her under deck space is entirely available for cargo. There are three watertight bulkheads, dividing her into four watertight compartments, irrespective of her double-bottom compartment for about 60 tons of water ballast; the *Joaquim* in this, as in other respects, is an exceptional vessel. Built under special survey, and to class 100 A1 at Lloyd's, during construction she was also overlooked by Captain Frantz, on behalf of the owners. She has wood decks, three hatches, two powerful winches, raised quarter-deck, on which over after-part is built a hood, enclosing the steering gear and affording protection to the man at the wheel, also a w.c. and a lamp-room. Entering the after deck-house from the quarterdeck, you have the mate's room on port, a comfortable, well-lighted place, then proceeding you come into the saloon, tastefully done up in pitch-pine panelling with teak mouldings and mahogany fittings; a neat skylight and two side ports afford good light and air; off this is the captain's room, fitted up same style as saloon; then on starboard side of passage is the pantry and steward's store. The forward deck-house is fitted up for eight of a crew, also a room for boatswain and steward, and a large roomy galley. The windlass is on the main deck under monkey forecastle and worked by capstan overhead, a strong anchor crane being also provided. She has been specially designed and built for shallow waters in Brazil, and carries a steam launch of large power to assist her in river navigation. Owing to the arrangement of water ballast the vessel will lose no time in port, by shifting

berth to take in or out the usual sand or stone ballast, the importance of which will be seen at once. She has been built very expeditiously, having been only 50 working days on the stocks from the time the frames were started till she was put into the water, and 60 till she was completed, a fact that reflects great credit upon the officials. The vessel was greatly admired as she left the dock and proceeded to sea.

Minerva.—On June 3rd the new saloon paddle steamer *Minerva*, one of the latest additions to the fleet owned by the Glasgow and South-Western Railway Co., went down the Clyde on her official trial trip. The results were highly satisfactory, an average speed of over 17½ knots having been attained.

Penarth.—On Saturday, June 3rd, the fine new large steel screw steamer *Penarth*, which has just been built to the order of Messrs. Morel Brothers, of Cardiff, by Messrs. William Gray & Co. Limited, of West Hartlepool, and engined at the Central Marine Works of that company, had her trial trip in Hartlepool Bay. The vessel takes Lloyd's highest class, and is of the following dimensions:—Length, over all, 335 ft.; breadth, 42 ft. 6 in.; depth, 23 ft. 1 in. A full account of her construction and outfit was given at the time of her launching. The engines are of the well-known type of the Central Works, the cylinders being 24 in., 38 in., and 64 in. in diameter, with a piston stroke of 42 in. Steam is supplied by two large boilers, built on the improved method advocated and adopted by these builders. The vessel proceeded to sea late on Saturday afternoon, and after some time spent in adjusting compasses, a short run at full speed was made to test the working of the engines. At a very high rate of revolutions a speed of 11½ knots was secured, the supply of steam from the boilers being fully kept up. Not the slightest trouble of any kind arose, the machinery running the whole time without any heating of bearings whatever, and without the application of water. The freedom, rapidity, and convenience with which the special reversing gear supplied with the Central Marine engines enabled the engineer in charge to reverse the engines from ahead to astern, or stop and start at will—in something like ten seconds —was remarked upon as an important and valuable feature in these engines. Mr. Thomas Morel, of the firm of Morel Brothers, of Cardiff, and Mr. Thos. Morel, junr., together with Mr. F. Goode, who has superintended the construction of both the ship and her machinery, were present, and Mr. Baines and Capt. J. E. Murrell represented the builders of the engines and hull respectively. "Success to the *Penarth* and her Owners" was proposed by Mr. Baines, who remarked that this steamer, which he understood was the largest steamer owned in the port of Cardiff, would be advantageous to the firm in every way. Mr. Thos. Morel in reply expressed his satisfaction with the design, construction, and completion of the ship and her machinery. Captain Holt, one of Messrs. Morel's senior captains, is commanding the vessel. The party having landed, the vessel proceeded to Cardiff to load.

Yarrow.—On June 3rd the s.s. *Yarrow*, built by Messrs. R. Napier & Sons, Govan, for Messrs. William Sloan & Co., Glasgow, had a most successful trial on the Firth of Clyde, when all the conditions of the contract were fully implemented. This new steamer has been specially designed for service between Silloth and Dublin, calling during the summer season at Douglas, Isle of Man, and should prove a very attractive vessel for tourists frequenting that favourite resort. The *Yarrow* is built of steel to the highest class at Lloyd's and the British Corporation, and her principal dimensions are:—Length, between perpendiculars, 230 ft.; breadth, 32 ft.; depth of hold to main deck, 14 ft. 10 in., with a long poop, bridge, and topgallant forecastle, and has very superior accommodation for about 70 first-class passengers. A deck-house on the poop contains six special staterooms, and the entrance hall in polished mahogany furnished with sofa seats and india-rubber matting on the landing, while a wide stair with handsome mahogany rails and balustrades leads to the cabins on the main deck. The saloon is finished in solid wainscot oak, with fluted columns, gilt capitals and cornice, while the ceiling is covered with lincrusta relieved by gilt mouldings, the effect being bright and tasteful. There is a handsome oak sideboard with marble top at the fore-end, and the revolving chairs are upholstered in old gold Utrecht velvet. The state rooms are very roomy and comfortable, with polished mahogany fittings, Smith's folding washstands, electric bells and lights, damask curtains, &c., and there is also a commodious ladies' cabin furnished in the same style. All the most modern improvements have been introduced for the comfort of the passengers, including a complete installation of electric lighting throughout the vessel, and a system of ventilation by induced draught to remove the vitiated air from the cabins and holds. The boats are all carried on beams above the bridge deck, leaving a clear promenade all fore and aft. The machinery consists of a set of triple-expansion engines having cylinders 21½ in., 34 in., and 57 in. diameter, by 42 in. stroke, and two single-ended boilers for a working pressure of 165 lbs., with all the most recent appliances for economy and efficiency; and the results of the trial were most satisfactory, a mean speed of 13½ knots having been maintained without a hitch of any kind.

Ardandhu.—On June 6th the *Ardandhu*, lately launched from Messrs. Workman, Clark & Co.'s shipyard at Belfast, proceeded down the lough for a preliminary trial. This proved most satisfactory, a speed of 13 knots being obtained. The vessel, which is the latest addition to the Ardan Line of steamers, has been built to the order of Messrs. Clark & Service, of Glasgow, and is intended for their trade between that port and the West Indies.

Bannockburn.—On Thursday, June 8th, the s.s. *Bannockburn* left the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesbrough, for the official trial trip. This steamer has been built in four months, and is for the Montreal Transportation Co., of Montreal, Canada. The principal dimensions are:—Length, 254 ft.; beam, 40 ft.; depth, moulded, 21 ft. 4 in.; with a deadweight carrying capacity of over 2,700 tons. She has been built of steel to take Lloyd's highest class, and has a perfectly clear deck all fore and aft, with the exception of houses for the accommodation of the passengers and crew, and for the navigation of the vessel. She has been designed specially for the trade on the great Lakes of North America, and as the locks on the St. Lawrence (through which she will have to pass before she can reach the lakes) are much too short for the length of the ship, efficient provision has had to be made to enable the vessel to be cut in two portions, each of which will float at a suitable draft, and when she has cleared these short locks the two portions will be rivetted together again. The steamer is rigged as a three-masted schooner, and is fully equipped with every improved appliance for the rapid loading and discharging of cargo, and a large number of hatches are provided for this purpose. The engines have been fitted by the North Eastern Marine Engineering Co., Limited, Wallsend-on-Tyne, and the cylinders are 21 in. 34 in., and 56 in., by 39 in. stroke, with two large steel boilers working at a pressure of 160 lbs. per square inch. The construction of the vessel has been under the superintendence of Captain A. McMaugh, of St. Catherines, Ontario, Canada, and Messrs. Bruce, Harman, and Alex. Cleghorn, of Glasgow. The results of the trials were most satisfactory. The machinery, &c., working without a hitch.

Embiricos.—On Saturday, June 10th, the s.s. *Embiricos*, of Andros, built by Sir Raylton Dixon & Co., of Middlesbrough, for A. Embiricos, Esq., of Braila, left the Tyne for her official loaded trial trip, and the average speed obtained was 10¾ knots, being ¾ of a knot in excess of the contract speed guaranteed. This steamer has been built under the superintendence of Messrs. Wm. Esplen & Son, of Liverpool, and is of the partial awning-deck type, with poop above raised quarter-deck. Water ballast is provided in both peaks, and under the engines and boilers as well as in a deep tank forward of the boiler space. The decks are of chequered iron, and the principal dimensions of the vessel are:—313 ft., 41 ft. 2 in., and 21 ft., with a deadweight carrying capacity of over 3,500 tons on a very light draft. The fittings throughout are of first-class style, and all well established improvements have been embodied in the construction, including lighting by electricity. The engines are by Mr. John Dickinson, of Sunderland, the cylinders being 23 in., 37 in., and 60 in., by 42 in. stroke, with two large steel boilers working at 160 lbs. pressure.

Rio Purus.—On June 10th the new twin-screw steamer *Rio Purus*, built by Messrs. Murdoch & Murray, Port-Glasgow, and engined by Messrs. D. Rowan & Son, Glasgow, went down the river on her official trial. The vessel is for Portuguese owners, and is intended for passenger trading on the river Amazon. Her dimensions are:—170 ft., by 30 ft., by 17 ft. deep to promenade deck. The engines are a double set of triple-expansion, with cylinders 9 in., 14 in., and 22 in. by 18 in. stroke, supplied with steam from large tubular boiler at 160 lbs. pressure. On the promenade deck accommodation is provided for

48 passengers in large and airy state-rooms, provision for dining being made by two large tables placed on deck aft, which is the custom of the country. Special attention has been paid to the thorough ventilation of all parts, as air is one of the great essentials required. The vessel has been fitted with a complete installation of electric light, supplied by Messrs. Haddow, of Glasgow, and was much admired when turned on over the vessel on Saturday. A large company of ladies and gentlemen joined the steamer at Gourock, and she at once proceeded to the measured mile to run her speed trials. On a mean of two runs, one with and one against the tide, a speed of 11¼ miles was obtained, which was almost a mile over the guarantee. The engines ran all day smoothly and very economically. After the speed trials the vessel cruised lower down the Firth, returning in the evening to Port-Glasgow to be finally prepared for her voyage to Para.

Warren Hastings.—On June 10th the Indian troopship *Warren Hastings*, built by the Naval Construction and Armaments Co., Barrow, completed a series of trials in the Clyde. The trials were highly satisfactory on both the measured mile and six-hours deep-sea run, the contract speed being exceeded by a knot. The twin propellers are of Delta bronze, the diameter being 13 ft. 6 in., and the pitch 15 ft. 3 in., each blade weighing about 26 cwt. The I.H.P. developed was 3,500, and the revolutions 135 per minute.

Elax.—This ship, which is the fourth built by Messrs. Wm. Gray & Co., for Messrs. M. Samuel & Co., of London, proceeded to sea, and was fully tried on the 12th June. She is of rather larger dimensions than the first three built on this account by Messrs. Gray & Co., and her construction has like them been superintended by Messrs. Flannery, Baggallay & Johnson, of London and Liverpool. She has a length of 347 ft., breadth of 45 ft. 6 in., and depth of 28 ft. 6 in., and is driven by engines having cylinders of 26 in., 42½ in., and 70 in. diameter, with 45 in. stroke, and taking steam from three large single-ended boilers of 14 ft. 1 in. diameter, and 10 ft. length. Her construction is very similar to those of the three previous vessels turned out by Messrs. Gray & Co., she being intended for the same, carrying petroleum to the east, and returning with general cargo. She bears the same special fittings for this purpose and for efficient and thorough venlilation to secure immunity from danger, and also to ensure that no damage to ordinary cargo takes place, and as the experience with similar boats showed the thorough ventilation capable while the cargo is in, is the most important feature, more especially in hot climates. Her machinery worked during the whole of the trial in a most satisfactory manner, no stoppage nor cause for complaint showing itself. Between 1,400 and 1,500 H.P. were indicated by the engines driving the ship fully loaded between the Tyne and Dover, at nearly 11 knots, when she proceeded down Channel to take up her duty.

Cimbria.—On June 13th the s.s. *Cimbria*, a very finely modelled steel steam fish carrier, left the Cleveland dockyard of Sir Raylton Dixon & Co., Middlesbrough, for the purpose of testing the speed and the general working of the vessel. She has been built for Danish owners (under the superintendence of Captain Solling), to carry from Iceland to the Hull and Grimsby markets, and is provided with every appliance for ensuring success in her special trade. Her lines, especially designed, are very fine and much admired. Holds for the carrying of the fish are provided with special insulation, and large ice hold, and the after peak is fitted as a water ballast tank, for the trimming of the vessel under varying conditions. Roomy accommodation for the captain and officers is placed aft, and this includes a very neatly decorated saloon. The principal dimensions of the vessel are:—Length, 145 ft. 6 in.; beam, 21 ft. 6 in.; depth, moulded, 12 ft. 4 in.; and the engines have been fitted by the North-Eastern Marine Engineering Co., Limited, of Sunderland, the cylinders being 14 in., 22 in., and 35 in. by 24 in., with a large steel boiler working at 160 lbs. pressure. During the trials everything worked well, and the vessel will steam 11 to 12 knots on her voyage in the Iceland fishing trade.

Knight Templar.—On June 13th the steam tug *Knight Templar*, built by Messrs. Mackie & Thomson, Govan, for Messrs. J. Prendiville & Co., Liverpool, to the order of Messrs. Dunsmuir & Jackson, Govan, who supplied the engines, went on her trial trip. The vessel is 95 ft. long, by 20 ft. 8 in. by 11 ft. 6 in. and is driven by a set of triple-expansion engines—with cylinders 13 in., 20 in., and 34 in. diameter by 24 in stroke—working at a pressure of 200 lbs. She is fitted with all the latest appliances for towing, and has a Myers' patent propeller. The usual speed trials were made on the mile at Skelmorlie, when everything was found to be to the satisfaction of all concerned. The speed attained was about 11¾ knots per hour.

Sea King.—On Tuesday, June 13th, the steam trawler *Sea King*, lately launched by Messrs. Cumming & Ellis, from their shipyard at Inverkeithing, was taken down the Forth on her trial trip. A large number of gentlemen interested in the fishing trade were aboard, and the vessel, which is of exceptional size and power, was the subject of much remark. The dimensions of the *Sea King* it may be mentioned here are 112 ft. by 21 ft. by 11 ft. moulded, with engines capable of driving her a steady 12 knots at sea. After adjusting compasses the *Sea King* was headed for the measured mile at Gullane, when, as the result of a number of runs, a mean speed of 12.52 knots was obtained, the engines, which were fitted by Messrs. Muir & Houston running smoothly and without a hitch, the whole time, with steam blowing off at the boiler. Every satisfaction was expressed at the result of the trial; the speed obtained more than realizing the expectations of those concerned with the vessel. On the conclusion of the trials, dinner was served in the saloon, where the various toasts suitable to such an occasion were given and responded to. The vessel was then headed for the North Sea, and on attaining the three mile limit, in order to give the company a practical demonstration of how trawling operations were conducted, the trawl gear was put overboard for the space of about a hour. The operation of getting the gear aboard again was watched with great interest by the company, all the machinery in connection with taking it on board working smoothly and without a hitch. In the *Sea King* the trawl ports were arranged by the builders in such a way as was thought would keep the trawl hawsers square to the rollers at all times, in getting the gear aboard, and their expectations regarding them were fully realized. On getting the nets aboard a fair quantity of fish was found and the company on the run home was treated to a fish supper. The vessel arrived safely back in Leith, the whole company expressing their satisfaction at the pleasant day's outing. Before parting, the owners expressed their entire satisfaction with the result of the day's trial and with the strong, substantial and well-finished character of the vessel.

Golondrina II.—On June 14th the steel twin-screw steamer *Golondrina II.*, which has been built by Messrs. Mackie & Thomson, Govan, for Captain Piaggio, of Buenos Ayres, went on a trial trip in the Firth of Clyde. The vessel, which it will be remembered was launched on the 17th May, is 706 tons gross, 200 ft. long, 28 ft. broad, and 25 ft. deep from the shade deck. She is built to the Bureau Veritas highest class for passenger service, and is intended to ply between Monte Video and Buenos Ayres. Internally she is specially arranged for service in a hot climate, and her accommodation is all over decidedly above the usual run. There are on the main and awning decks quarters for 90 first-class and 72 second-class passengers, and aft on the main deck is a tastefully-decorated dining-saloon, with seats for nearly 100 persons. Over the awning-deck, to protect passengers from the heat of the sun, is a canvas covered shelter deck, on which are the navigating bridge and wheel-house. Two sets of triple-expansion engines of 1,160 I.H.P. have been supplied by Messrs. Muir & Houston, Kinning Park. The cylinders are 13 in., 21 in. and 33 in. in diameter, and the stroke 22 in. On the invitation of the builders a number of ladies and gentlemen joined the steamer off Prince's Pier, travelling from the city in saloon carriages attached to the 10.5 train. Amongst those present were Councillor James Houston, Councillor Wyllie, Mr. W. A. Mackie and Mrs. Mackie, Mr. R. H. B. Thomson, Mr. C. Houston, Mr. Robin, Captain Piaggio, Mr. C. Pile, Mrs. Mackie, Mr. Robert Mackie, and Miss Mackie, Dr. Barras, Mr. William Robertson, Mr. Meiklejohn and Mrs. Meiklejohn, Miss Colville Meiklejohn. Mr. James Houston, jun.; Dr. J. C. Herbertson, Mr. J. M. Pollock, Mr. J. A. Stewart and Mrs. Stewart, Mr. S. M'Knight, Mr. Robert Balfour and Miss Balfour, Mr. George M'Farlane, Miss Tonkin, Captain Avery, Mrs. Leyman, and Mr. C. Robinson. Leaving the Tail of the Bank shortly before noon, the vessel proceeded in delightfully fine weather on the customary six hours' trip. Two double runs at the rate of 12¾ knots were made between the Cloch and Cumbrae Lights, at the conclusion of which the vessel returned to Prince's Pier. On the concluding run dinner was served in the saloon. Mr. Mackie, who pre-

sided, proposed "Success to the *Golondrina II.*," and Mr. Archibald Low replied for Captain Piaggio. Mr. James Houston gave "The Builders." Messrs. Mackie & Thomson well deserved the honour, he said, for they had turned out a magnificent ship for their good friend the captain. There was not, he believed, a better shipbuilder on the Clyde than Mr. Mackie, and with the support of his friend Mr. Thomson, he was able to turn out vessels second to none. Mr. Thomson replied. Mr. M'Farlane proposed "The Engineers," and Mr. Houston replied.

Onyx.—On June 14th the new first-class gunboat *Onyx*, built and engined by Messrs. Laird, of Birkenhead, underwent an eight-hours full-power trial of her machinery at the mouth of the Thames. The ship, which has just been delivered under the Naval Defence Act, was tested under natural draught and with a pressure of steam of 125 lbs., and, the engines working 218 revolutions per minute, a mean of 2,531 H.P. was developed, with a speed of 17.5 knots. The results were considered satisfactory, and the *Onyx* returned to Sheerness to prepare for her forced draught trial. The official forced draught trial of the *Onyx* took place on Friday, the 16th June, under the superintendence of officials representing the Admiralty and the Sheerness Dockyard Reserve. With a pressure of steam of 140 lbs., and the engines working 247 revolutions a minute, a mean of 3,546 H.P. was indicated, with a speed of 19 knots. The *Onyx* returned to Sheerness Harbour, and will be immediately completed for commission.

Fairy Queen.—On June 15th the trial trip of the new saloon steamer *Fairy Queen* took place. The steamer has been built for passenger traffic on the Forth and Clyde Canal between Glasgow and Craigmarloch, and is commodiously fitted up for that purpose. The outward run was from Port Dundas to Craigmarloch.

Delaware.—The s.s. *Delaware*, built by Messrs. David J. Dunlop & Co., engineers and shipbuilders, Port-Glasgow, to the order of the Anglo-American Oil Co., Limited, of London, for carrying petroleum in bulk between the United States and Great Britain, successfully underwent her different trials on the 16th and 17th inst., when the conditions required by the owners through their contract and specifications were fully carried out. The principal dimensions of the *Delaware* are:—Length between perpendiculars, 345 ft.; breadth, moulded, 44 ft.; and depth moulded to spar deck, 31 ft. 6 in. The gross deadweight on board at the time of the trials was 5,400 tons. The engines are triple-expansion, and have cylinders 27 in., 43½ in. and 70 in. diameter, by 51 in. stroke, with two large double-ended boilers, the working pressure being 160 lbs. per square inch. The highest mean speed attained on the progressive trials, which took place on Friday June 16th, was fully 12½ knots, while this speed was easily sustained and a full command of steam upheld during the six hours' consecutive steaming which took place on Saturday, June 17th, the engines working during the whole of the trials without the slightest hitch of any kind. The "Snow" pumps, with which the steamer is fitted, for discharging either water ballast used for the voyage out or petroleum cargo for the voyage home, were tried on Saturday and discharged part of water ballast cargo at a speed of about 800 tons per hour. The electric light, as supplied by Messrs. J. H. Holmes & Co., was also tried and worked most satisfactorily, while Messrs. Brown Brothers & Co.'s steam tiller and telemeter gave every satisfaction on the various manœuvres through which the steamer was put on the two days of her trial. The construction of the *Delaware* has been superintended throughout by Mr. Archibald Blair, general superintendent for the Anglo-American Oil Co., and Mr. James M'Ewen, local surveyor. The owners were represented at the trials by Mr. John D. Jamieson, managing director for the company in London, who was accompanied on Saturday by Mrs. Jamieson, several officers from H.M.S. *Superb*, and a large party of ladies and gentlemen, who enjoyed the cruise under the conditions of brilliant weather with which the trip was favoured.

Pholas.—On Wednesday, June 21st, at Greenock, the new hopper-dredger *Pholas*, recently launched by Messrs. Wm. Simons & Co., Renfrew, completed its dredging trials with very satisfactory results. It raised quite easily over 400 tons of dredgings in an hour, and dredged to 32 ft. depth of water, and afterwards proceeded to Skelmorlie, and the speed trial showed a result considerably in excess of the contract. The *Pholas* is built to the order of the Crown agents for the Colonies, and in a few days will leave here for St. John's Harbour, Antigua, where it is to be employed.

Twin-Screw Hopper Barges.—On June 22nd the speed trial took place of the first of two barges ordered on the 7th of February by the Clyde Navigation Trustees, as an addition to their existing plant, from Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley, each to carry 1,200 tons on 13 ft. draught and steam when loaded at a speed of 10½ knots per hour. The trial took place between the Cloch and the Cumbrae Lights, a run being made with and against tide over a distance of 27½ knots. The barge was loaded with 1,200 tons of dry sand from Cessnock Dock, which, added to the water in the hoppers, made a total load of 1,400 tons. The result of the trial was in every way satisfactory, the barge carrying her load within her draught and steaming quite up to her contract speed, the engines and hopper door machinery giving the greatest satisfaction to the representatives of the Clyde Trust.

Ali Dadoscheff.—There was lately taken on her trial trip the new petroleum-carrying steamer, *Ali Dadoscheff*, built by the Kockum Engineering Co., Sweden, for a firm at Baku. The vessel is 155 ft. long, and 27 ft. 9 in. beam. Motive power is supplied by a set of engines of 350 H.P., and at the trial a speed of 9·4 knots was attained.

Etruria.—The cruiser *Etruria*, built by Messrs. Orlando Bros., Leghorn, for the Italian Government, was lately taken for her trial trip under natural draught. A speed of 17½ miles per hour was attained, the engines indicating 4,500 H.P., and the average revolutions being from 122 to 123.

Mary Patten.—The trial trip took place lately of the paddle steamer, *Mary Patten*, built by Mr. Samuel H. Pine at his yard at Greenpoint, L.I., U.S.A., for the New York and Long Branch Steamboat Co. The vessel is built of wood, and is 170 ft. long, 28 ft. beam, and 8 ft. deep. Motive power is supplied by a beam engine, constructed by Messrs. M'Curdy & Warden, New York, the cylinder being 36 in. diameter by 7 ft. stroke.

Soderhamn.—The new steel cargo-steamer *Soderhamn*, built by Messrs. Burmeister & Wain, Copenhagen, for Herr G. M. Gehrkens, Hamburg, was taken for her trial trip lately with successful results. The vessel is 200 ft. long, 31 ft. beam, and 15 ft. 4½ in. deep. Motive power is supplied by a set of compound engines.

Reviews.

Practical Electrical Light Fitting. By F. C. Alsop. London: Whittaker & Co. 1892.

We have reviewed several works recently which have treated of electric lighting at sea, and it is exceedingly interesting to come across a good book on installations for the same purpose on land. We find here directions as to the planning of the wiring of buildings—always a very important matter, not only for economy of installation, but also of that of subsequent working—full description of wall and ceiling fittings, which are now so beautifully designed; and accounts of the various devices by which electricity can be applied to other domestic purposes than simple illumination. Now-a-days, the man who wants to have his place fitted with the electric light has a sad time before him. He is supremely ignorant on the subject, and has little idea as to the cost of an installation, nor can he tell what is the kind of dynamo and engine best fitted for his particular case. He asks for estimates from various firms (and there is no difficulty in getting shoals of them), but the prices asked are as different as the plans suggested. To one in such bewilderment, Mr. Alsop's book comes as a welcome clue to lead him out of the labyrinth. Let him read this book, and he will be able to take an intelligent view of the position, and to hold his own with the contractors. The plans of house installation are especially instructive, and the practical style of the book may be gathered from the fact that the fire office regulations on the subject of electric lighting are printed in detail.

Knots, Splices, Bends and Hitches. By F. R. Brainard, Ensign U.S. Navy. New York: The Practical Publishing Co. 1893.

A practical explanation by a practical man. The book is furnished with very complete illustrations, wherein clearness is not sacrificed to elaboration, and not only are the methods of making the knots themselves explained, but the uses to which they can

be most suitably put are given. A glossary of very succinct definitions is added, and tables of weights and strengths of various sizes of hemp and wire ropes are not forgotten.

Steam may to a large extent have displaced the "white wings" of the old days in the mail and naval services, but the sailing ship of to-day still has its work. Though its proportion to the whole tonnage of the world may be less than heretofore, its absolute quantity has not seriously decreased. We cannot conceive a state of things in which sail power at sea will be entirely dispensed with. If it were only as a training for deck-hands of steamers there is always a necessity for sailing vessels and no shore man is as handy as the old salt with his knowledge "of the ropes." Even in pure engineering matters the labourers who have seen service before the mast are often the smartest in rigging up tackle to deal with heavy weights, and we feel confident that the information contained in books of this class will never be obsolete. The present work is not only clearly written by a man who has thoroughly mastered the subject he deals with, but it is written in a thoroughly condensed style, and gives all the requisite information without the least unnecessary verbiage.

Die Technische Entwichlung des Nord-deutchen Lloyd's und der Hamburg—Amerikanischen—Packetfahrt — Actiongesellscharft. By R. Haack and C. Busley. Berlin: Julius Springer. 1893.

The present is a very appropriate time for the appearance of the present handsome volume, and that for several reasons. In the first place now that the Americans have discovered Southampton (as an Atlantic port), it is well for them to be reminded that their claims have been anticipated by the Germans for the respectable period of very nearly forty years. So long a time has elapsed since the fleets of the Hamburg and North German Lloyd Co.'s began those regular services which are to-day maintained by such vessels as the *Furst Bismarck* and the *Havel*. The book contains no less than 572 woodcuts in the text, 11 diagrams, and 34 lithographed sheets of plans. The whole work may indeed be called exhaustive, and is a wonderful instance of the thoroughness which characterises German work. The execution of the letter-press and illustrations is such as is not often seen in our native productions. Whilst we are rightly proud of our Clyde-built *Campania* it is not amiss for us to learn the lesson writ large on every page of this volume. We see very clearly that if we are not standing still in the science and art of shipbuilding, foreign nations are advancing too, and that with great rapidity. Till some twenty years ago, these companies would never have dreamed of ordering even a coasting vessel from a German shipyard. For many years more they maintained their excellent habit of going to the Clyde for their express boats, and good value they received in such ships as those turned out of the Fairfield yard for the North German Lloyd Express Service, instituted in 1881. But a time came when they thought they had learnt all we had to teach them, and about six years ago they felt they could run alone, and both the companies were simultaneously attacked with fits of ordering greyhounds from the Vulcan Co. at Stettin. These alarming symptoms are, we trust, somewhat subsiding by latest reports, but we may be sure that they will recur at no distant date. When we regard such fine vessels as the *Furst Bismarck* (and, for that matter, *La Touraine*) we cannot fail to feel that our monopoly in this department is at an end. True, we can still produce work at a lower figure than our continental neighbours, but time and practice will bring them into more economical ways, whilst the vagaries of the British workman, assisted by restrictive legislation, will soon deprive us of the advantage we possess thanks to our cheap coal and iron.

Our authors describe vessels of all sorts and all ages. We are shown plans of the latest development of the shipbuilder's art, we also find plans of the greyhounds of thirty years ago, such as the *America*, built by Caird's in 1863. Coasting steamers and cargo boats for the service across the German Ocean, and vessels specially built for the ocean trade in goods and for the accommodation of emigrants, find their place in the fleets of the companies, and are therefore rightly included in a volume which aims at describing the whole of the vessels comprised in the two fleets.

In conclusion, we must say that although the letterpress is naturally closed to those who do not read German, the plans and diagrams are not, and we can assure our readers that in studying this book, they will make themselves familiar with the best class of shipbuilding practice, during the long period the simple low pressure engine reached its highest point and fell before the more economical compound.

A Condensed Treatise on the Law of Patents for Useful Inventions. By William E. Simonds, Ex-Commissioner of Patents. New York: 1893.

We have had occasion in these columns to discuss many pocket-books. We have frequently allowed (to use an Americanism that may be pardoned in this connection) that the author of a work under discussion had successfully condensed the subject with which he was dealing, but we have never seen anything of its kind equal to the present volume. In ninety-six pages (two of which are devoted to the index) Mr. Simonds gives a thorough and masterly *resumé* of the origin and present state of the patent law in the United States.

Such a work cannot fail to be of interest to many of our readers. Nowadays the world is so small that an invention of any general utility needs to be protected in all the principal countries. In discussing various books on English patent law, we have shown the necessity for some knowledge of the subject even by the inventor who employs a patent agent. He may master the rudiments of our law on the subject, but he can hardly be expected to learn those of every realm. Yet if there be time left to go further, he should certainly take the American next. And this for several reasons. In the first place, it is the most like our own, being, in fact, an offshoot from it. In the next place there is the advantage of the community of language and ideas between the two sections of our race. Finally, and most importantly, there is the fact that this is the law under which the largest number of patents are granted, many of them being patents of the greatest importance. It will be seen that in many respects the law is similar to our own. But in one or two important points there is a serious difference. For example, it will be well to notice that caveats (which are the method of obtaining provisional protection) can only be filed by citizens of the United States and aliens of twelvemonths' residence. This, of course, is very possibly an oversight, but it savours somewhat of the protective inclination, which distinguishes the authorities. But the most important difference is that in the duties of the officials of the two countries. In England the examiners are principally exercised about the question as to whether the applicant has consumed the requisite amount of red tape, and, of course, settled the inevitable fees. In the States something more satisfactory to the inventor is the result of the examiner's labour. That official does not confine his attention to the minor points, but goes to the root of the matter, and first of all searches the records to discover if the inquirer has anything to offer which is really patentable, and if he has not, he refuses his money. Here the inventor must take care of himself, there the department looks after him, and will not let him throw his money away. We cannot pursue this interesting subject further, but we feel sure that the book will repay perusal by those who intend to take out patents on the "other side," and we can further affirm that the author at, least, has a very thorough knowledge of the technicalities of his profession.

Correspondence.

[It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—Ed. M. E.]

NEW PADDLE STEAMER "LEOPOLD II."

To the Editor of The Marine Engineer.

Sir,—In your last month's issue of The Marine Engineer we note you have a very interesting account of the new paddle steamer *Leopold II.*, built by Messrs. Denny & Bros., of Dumbarton, for the Belgian Government. With reference to the four large double-breasted fans for the forced draught, these were, however, manufactured by us, and not by Messrs. Drysdale & Co., which your account seems to imply. We also supplied the engines for driving these fans, and we should be much obliged if you will kindly correct this in your next issue. Apologising for troubling you,

We remain,
Yours faithfully,
Bumsted & Chandler.

June 12th, 1893.

Steam Navigation on the Caspian.—Mr. Churchill, our Consul at Resht, in Northern Persia, devotes a section of his latest trade report to the navigation of the Caspian. A company subsidized by the Russian Government carries the mails. The steamers run once a week between Astrakhan, Baku, and Enzelli, and back to Astrakhan. A weekly service also exists on the east coast from Astrakhan to Uzun Ada, Chekishlar, Gez, and Meshedi Ser, touching at two or three intermediate ports between Astrakhan and Uzun Ada. This is, however, only during the summer months, when the Volga is open; when that river is frozen—between the middle of November and the beginning of April—there is only a fortnightly service. Besides, there is a service twice a week all the year round from Baku to Uzun Ada, the terminus of the Trans-Caspian Railway. Enzelli being an open roadstead exposed to the north winds, that blow with much force in autumn and winter, is often difficult to land at, and it sometimes happens that travellers who have caught the fortnightly steamer at Baku have to return to that place, having been unable to land at Enzelli, and are obliged to spend about ten days at Baku and make a further attempt on the next journey. There are a number of small coasting steamers that lie outside Enzelli harbour—sometimes for days—waiting for calm weather, when, if they are of very light draught, they pass the bar and then get into the inner protected harbour. Most of the trade between Persia and Russia is carried on by means of these steamers. It is said that competent Russian engineers who have studied the bar at Enzelli report that it offers no engineering difficulties. The bottom being mere mud and sand, it could easily be removed by dredging. This would enable the mail steamers to enter the inner harbour at all seasons. Meshedi Ser, another Persian port, situated on the coast of Mazanderan, like Enzelli, is an open roadstead, and still more exposed and consequently more difficult to land at, and moreover, the bar is more difficult to cross. It has the advantage, however, of being six easy stages for mules to Teheran. A good deal of trade is done with Russia at this place. It is mostly in the hands of Armenian traders. There only remain two Persian ports of commercial importance where the mail steamers touch, Astara on the Russo-Persian frontier, and Gez, the port of Astrabad. Astara is the port of export for the whole of North-Western Persia, Azerbaijan province in particular. There are two towns of that name, the one being Persian and the other Russian. The frontier is traced by a river. Persian Astara is by far the more important of the two, being the terminus of the caravan route where much traffic goes on, and numerous warehouses and caravanserais exist for storing merchandise previous to shipping to Russia and loading for the interior of Persia. The road, however, like all roads in Persia, is detestable, and passing over high mountains, narrow defiles, and numerous precipices, renders trade in perishable articles somewhat precarious. Russian Astara is merely a military frontier post. The port of Gez (or Bander-I-Gez) is the best and only good harbour on the Caspian coast of Persia. It is situated in the Gulf of Astrabad. The channel to it is deep and well buoyed by the Russian Government, who have the military station of Ashurada, on a spit of land commanding the harbour. Ships of the largest size navigating the Caspian are able to enter the harbour in any weather, and at all hours of the day or night. The harbour is quite sheltered, and can hold any number of vessels. It is far better than any the Russians have on the east coast of the Caspian. Much trade goes on at this place, mostly in cotton from Persia, principally from Khorassan, and petroleum, sugar, cotton goods, crockery, &c., imported from Russia for consumption in the provinces of Astrabad and Khorassan.

Anti-Fouling Composition.—We have received a copy of the latest circular issued by Messrs. Suter, Hartmann & Rahtjen. Like its predecessors it is embellished with an illustration of a recent production of the shipbuilder's yard to which the firm's well-known composition has been applied. The cover shows us the flags of half-a-dozen of the principal maritime nations, who use the composition, and the picture is that of one of the eight great battleships which our Admiralty has so recently added to the effective list. The list of customers and the extent to which they use the composition seems to expand with great steadiness. Her Majesty's Fleet heads the list, because it is the biggest in the world. It has 350,000 tons covered. Then comes the P. & O. Co., with 187,933 tons. This must be its entire fleet. The Anchor Line has 124,827 tons and the White Star 85,563 tons. Inman's (or the American Line, as it should now be called) has 31,726 tons. These companies have evidently coated all their vessels, whilst the National, Royal Mail and Cunard Lines show their appreciation by applying it to very many of their ships. The *Campania* is the latest Cunarder treated. Nothing affects the speed of a vessel more than the state of her bottom. The circular also contains a list of the firms using the well-known "grey paint." From this we see that the desire of the age to buy the cheapest article in the market, regardless of its value, has not restricted the sale of the paint in spite of its apparently high price.

Pumping Machinery.—Messrs. Worthington's illustrated catalogue, issued at the commencement of the present year, comprises a vast assortment of the various classes of machinery for which their name is justly celebrated. On perusing the list one is astonished at the various types of pumping machinery it includes; and further at the large number of sizes in which each type is stocked. Great variety of types is less astonishing, however, to those who know the fact that Messrs. Worthington turn out, on the average, no less than 30 completed appliances every day. Yet with all this wealth of choice the intending purchaser has no cause for bewilderment or confusion, for the list is a model of what such publications ought to be, but seldom are, viz., models of arrangement and clearness. Simple explanations of its powers and the purposes for which it is best adapted, are furnished, together with a well-executed cut for each variety of machine, whilst to facilitate reference, and to make it easy to give orders by telegraph, the code word is printed, with the price, to each size stocked. The facilities afforded to those "drowned out," or requiring pumps in any other emergency, may be gathered from the fact that there is a stock of 1,500 pumps held ready for instant shipment at the principal ports at home and abroad. This, the oldest firm of its kind, is still in the front in introducing improvements. A recent invention has enabled them to combine the advantages attending the use of direct-acting engines with the economy effected by the use of a variable cut-off. Thus the steam may be used expansively with the consequent reduction in coal consumption. Meanwhile the pumps themselves have been strengthened to enable them to withstand the strains put upon them by the high steam pressures now commonly employed.

The First French Tanker.—There is to be seen at present in one of the basins at Havre, an elegantly-modelled steamer, which is the first vessel built in France for the carriage of petroleum in bulk. It is well known that the carriage of petroleum in barrels across the Atlantic has been abandoned for some years; and that from motives of safety and economy a system has been adopted whereby it is conveyed in specially constructed ships, whose tanks have a capacity of many hundreds of cubic yards. Up to the present time England had the monopoly of the building of this class of vessel, and it was to her that the shipowners of France turned when they were in need of a vessel of this kind. This state of things might have endured if MM. Deutrel had not taken a very praiseworthy step in contracting with the Société des Forges et Chantiers de la Mediterranée for the building of a vessel which has just completed her trials. This vessel, which is named the *Lion*, is 85 metres (236½ ft.) in length, 12 metres (39½ ft.) beam, and of the loaded draught of 6·1 metres (19 ft. 10 in.). She is capable of carrying about 2,800 tons of petroleum. According to the contract her speed was to be 9½ knots when loaded, and her coal consumption 750 kilogrammes per hour. On the ten hours' official trial the speed actually made was ten knots, and the coal consumption only 580 kilos. The vessel seemed satisfactory in all respects.—*Journal des Debats*, June 8th, 1893.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from May 20th to June 13th.

9301 A. J. Boult. (A. W. Case, U.S.) Screw propellers.
9310 A. J. Boult. (The Bruno Nordberg Co., U.S.) Cut-off gear.
9312 W. P. Thompson. (E. Niehoff, U.S.) Raising sunken vessels.
9313 A. Lagrafel & J. d'Allest. Steam boilers.
9326 J. W. Ray. Ships' dials.
9343 G. Heritage. Hydraulic valves.
9361 M. H. Smith. Gearing.
9370 A. J. Maginnis. Improved steam boilers.
9392 W. H. Harfield. Ships' steering gear.
9403 J. Schmittdiel. Condensing apparatus.
9413 W. E. & R. Bracewell. Vice screw.

9429 W. H. Armstrong. Steam-reducing valves.
9430 J. W. Scott. Securing ships' hatchways.
9432 A. Sime. Tubular steam generators.
9434 W. Caldwell. Building and ship ventilation.
9447 F. W. Zimer. Screw-propelled boats.
9461 J. Temperley. Apparatus for loading vessels.
9484 C. Billington, sen., & J. Newton. Water gauges.
9496 J. Hope. Ships' course recording apparatus.
9502 A. Wait. Anchors.
9564 E. Hunt. (R. T. Love, West Indies). Steam traps.
9625 A. R. U. A. Paetzelt. Ships' rule.
9644 L. F. Pearson. Boiler furnaces.
9667 A. W. Bibby. Controlling the motions of ships.
9678 J. W. Noble. Ships' anchor.
9700 H. V. Keeson. Construction of navigable vessels.
9726 H. Walton. Steam trap.
9743 W. H. Wilson. Tubulous steam boilers.
9751 C. E. Stephenson. Automatic indicator.
9781 F. E. G. Lambart & J. F. Owen. Ship's table.
9785 W. Buckwell. Valves.
9796 C. B. Hussey. Rafts.
9824 F. B. Wells. Wrenches.
9829 W. S. Simpson. Propulsion of vessels.
9871 J. McGregor. Dredging by means of pumps.
9875 W. F. Spence. Oar locks.
9971 G. A. Farini. Valves.
9975 J. R. Thame. Life buoys.
10017 L. S. Dulac. Furnaces of steam boilers.
10022 J. Pitlik. Preventing incrustation in boilers.
10105 C. R. Eddy & S. E. Whitehead. Windlass.
10119 J. C. Peache. Compound tandem engines.
10120 S. A. Johnson. Light draught steamers.
10136 J. & A. Niclausse. Metallic boiler joints.
10144 G. C. Baker. Submarine boats.
10181 P. Ashberry & W. Barnes. Flexible shafting.
10212 F. Steffens. Boiler furnaces.
10239 J. C. Fell. (H. C. Goodell & W. E. Richards, U.S.) Non-conducting coverings for boilers, &c.
10245 J. Menzies & R. Rogerson. Slide valves.
10256 H. McIntyre. Adjusting the pitch of screw propellers.
10267 J. S. Comrie. Indicators for torpedoes.
10286 W. P. Thompson. (A. Decke, Germany.) Supplying air to furnaces.
10305 C. Brunner. Speed indicators
10326 W. Balls. Sluice ports of ships' bulwarks.
10383 A. E. Allen. Feed heaters for boilers.
10388 W. P. Thomson. (T. Delville, Belgium.) Valve gear.
10391 W. Craige. Pipe wrenches.
10398 G. C. L. Lenox. Effecting electrical communication with vessels at sea.
10403 J. Borni. Improved clips for securing chains.
10415 W. Green. Anchor.
10416 T. Wood. Circulating boiler.
10421 The Palatine Engineering Co., Limited, & R. Blakiston. Recording the level of water.
10429 M. Murray. Holder for lids of vessels.
10430 W. G. Wrench. Reducing valves.
10438 J. Yorke. Governing propeller engines.
10467 E. Latham & E. G. Guyot. Evaporators.
10468 W. Sisson. Governors.
10474 J. S. Bolton & T. J. Murday. Accumulators.
10475 T. Browett, H. Lindley & F. C. Gibbons. Engines.
10496 R. S. Blackburn. Operating steam valves.
10591 J. L. Young. Emptying hollow vessels.
10614 A. J. Boult. (C. H. Shaw, U.S.) Steam generators.
10632 C. E. Evans. Flotation chambers for lifeboats.
10642 W. R. Lake. (C. R. & G. A. Ayer, U.S.) Down-draught steam boilers.
10646 J. Owens. Pioneer land traction and steamboat.
10653 A. H. Valda. Improved navigable vessel.
10664 J. & G. Weir. Separating fatty matters from water.
10676 W. & J. Cormack. Boilers.
10711 S. Ryder. Torpedoes.
10766 W. E. Sanger. Rowlocks.
10770 W. H. & R. Thompson. Applying lubricators.
10790 J. Menzies & R. Rogerson. Slide valves.
10798 W. J. Thomas. Propulsion of vessels.
10809 W. Hughes. Manufacture of boiler tubes.
10811 T. White. Trawl net.
10828 E. R. Calthrop. Thrust bearings for shafts.
10859 F. C. Winby. Thrust bearings for shafts.
10861 J. Kershaw & W. Gerlach. Water gauges.
10869 E. Whalley. Lubricators.
10896 J. H. Ingham & J. Harwood. Lubricators.
10898 A. Haworth. Oars and rowing boats.
10968 F. A. Langen. Steering of ships or vessels.
10987 F. R. Brown. Electric propulsion of boats.
11004 T. Williams. Steamship propper.
11016 E. Storrs. Boiler furnaces.
11038 C. C. Peck. Boilers.
11051 G. H. Hamlyn. Ships' fittings and tackle.
11072 A. A. Fisher. Valves.
11119 R. J. Hammond. Stern wheel propelled vessels.
11120 R. J. Hammond. Paddle-wheels.
11159 G. H. Herbert & A. Marr. Steam generators.
11163 E. Garnier. Propelling and steering vessels.
11348 C. McLaren. Water gauge for steam boilers.
11373 J. P. Holland. Steering mechanism for boats.
11375 J. A. Cawley. Anchor.
11395 W. Bracewell. Effecting furnace combustion.
11453 E. H. Girling, R. G. Dallaway & A. Williams. Boats.
11481 G. A. Logsdail. Gauge glass.
11496 J. Whalley. Reducing steam pressure.
11504 G. N. Buchanan. Unloading timber vessels.
11508 D. A. Lowthime & S. J. Levi. Indicator.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1C, denotes First Class; 2C, Second Class.

May 27th, 1893.

Burnett, Jno...	2C	N.Shields
Cranch, Jno. ..	1C	London
Evington, Thos.	2C	Hull
Glen, Robt.....	2C	London
Harding, C. V.	1C	„
Harrison, H. E.	2C	N.Shields
Hood, Hy.	1C	London
Hulme, Percy C.	2C	Liverpool
Jackson, Wm.	1C	N. Shields
James, W. G...	2C	London
Kennedy, J. H.	1C	„
Kerr, Chas. E.	2C	N.Shields
Lawther, Jno.	1C	„
Lumsden, Robt.	2C	Liverpool
M'Allan, Andr.	1C	London
Matthew, W. H.	2C	N. Shields
Mitchell, F. D.	2C	London
Ponder, Thos. J.	1C	N.Shields
Smith, J. F. B.	2C	„
Swainston, T.	2C	„
Young, Richd.	2C	„
Young, Tom A.	1C	„

June 3rd, 1893.

Champion, A.	1C	Cardiff
Diack, Jas. A.	1C	Glasgow
Dove, Herbt. J.	1C	Cardiff
Finch, Francis	2C	Liverpool
Fleming, Wm.	1C	London
Hall, Stephen	2C	Liverpool
Henderson, J.	1C	Glasgow
Henry, Patrick	2C	„
Holt, Edw. J.	2C	„
Houston, R. G.	1C	„
Hughes, R. H.	1C	Cardiff
Jones, William	2C	Liverpool
Lamb, George	2C	Cardiff
McCoy, John R.	2C	„
Morgan, John..	2C	London
Mulvaney, E.	2C	Liverpool
Napier, James	2C	Glasgow
Peat, James D.	1C	„
Rowley, Robert	2C	Cardiff
Stevenson, A. L.	1C	London
Stewart, John	1C	Liverpool
Stewart, W. T.	1C	„
Watkins, Chas.	1C	Cardiff
Wilson, Robert	2C	Glasgow
Winny, Charles	2C	Liverpool
Wrigley, Edw.	2C	London
Young, Alfred	2C	Cardiff

June 10th, 1893.

Adams, Wm...	2C	Dublin
Anderson, Jno.	2C	N.Shields
Bulman, J. T...	2C	„
Cartmell, Geo.	2C	London
Graham, Thos.	1C	N.Shields
Hogg, J. D.....	1C	„
Husband, A. W.	1C	„
Jones, A. T. S.	2C	London
Lindsay, John	2C	Liverpool
Long, Jas. B.	2C	Dublin
Lyons, Jas.....	2C	„
Mulvany, Edw.	1C	Liverpool
Robertson, H.	2C	London
Thom, Geo. W.	2C	N.Shields
Tutin, Tom....	1C	Dublin
Wishart, Jas...	2C	N. Shields

June 17th, 1893.

Anderson, Jas.	2C	Greenock
Bell, Saml. A.	1C	Hull
Burton, A. J.	1C	„
Campbell, Geo.	2C	Leith
Chisholm, Jas.	2C	„
Chisholm, Jno.	1C	Greenock
Deans, Alex. R.	1C	London
Dees, Robt. J...	1C	Leith
Duguid, Jno. M.	1C	Greenock
Dunlop, Robt...	2C	„
Fairbairn, Jas.	2C	N.Shields
Forrest, Robt.	2C	Greenock
Fraser, Chris...	1C	Leith
Gibbesan, J. W.	1C	N.Shields
Harper, Jno. ..	1C	Greenock
Heaviside, C. E.	1C	N.Shields
M'Donald, Alex.	2C	Greenock
Moore, Jas. H.	1C	N.Shields
Orr, Wm. Jno.	1C	Greenock
Phillips, Thos.	1C	London
Service, Wm...	2C	Greenock
Simpson, Jno.	2C	„
Thorp, Richard	1C	Hull
Wilson, Nat. ..	1C	Greenock

The Marine Engineer.

LONDON, AUGUST 1, 1893.

THE month of July has seen the sitting of the second session of the International Maritime Congress, whose inaugural meetings were held in Paris in 1889. The present meetings have been presided over by Lord Brassey, who delivered a presidential address on the subject of our debt to the harbour-improving engineer for his part in the extension of our commerce. It is well to be reminded of what has been done in this respect. He has built the great breakwaters at Plymouth, at Portland, at Holyhead, and at Kingstown. Alderney, Peterhead, and Dover bear witness to his skill, whilst in the present century the rivers Clyde, Tyne, and Logan have been treated so as to admit ships where boats once grounded. He is now taking the Mersey in hand, and he promises that the abolition of the bar there is only the question of a short time; but he receives a little too much credit from the noble chairman when we are told that at low water the available depth of water there was only 10 ft. before the operations of deepening came to be undertaken. On subsequent days Mr. Lyster described the course of these works, and Mr. Blechynden the dredger which is to complete them. Mr. Mundella spoke with satisfaction on the international agreements as to the rule of the road at sea. He would like, and we agree with him, to see the question of loadlines, of stowage of grain cargoes, and of regulation as to timber deck loads settled by international agreement. If this could be done the British shipowner could no longer feel that the precautions he must take in excess of those enjoined on his rivals prevent his competing with them on equal terms. If the Congress can promote these agreements it will abundantly justify its existence. Mr. Kenward afforded a practical paper on side lights. He rightly contends that the three lights of a steamer should all be visible to an equal distance so as to insure a correct indication being given to other vessels encountered. With this end in view he fitted the s.s. *Roslin Castle* with a starboard light of a peculiar tint, since adopted by the Board of Trade; this light had an electric lamp of 200 candle-power behind it, and the port light was of 100 candle-power only, by these means he successfully attained his object. The important subject of electric communication with lightships was dealt with by Captain Leclerq, who pressed the method of inducted communication in use at the Needles as the best for the purpose. Commander Cameron thought that specially constructed vessels of a round form, capable of being firmly moored, should be adopted, when the connection with a cable would be easy, but the obvious difficulty of expense comes in. The development of speed in steamship traffic was dealt with by Messrs. Seaton as regards that of the narrow seas, and by Mr. Biles in relation to the Atlantic Ferry. In an interesting address, Sir Thomas Sutherland, of the P. & O. Co., reminded us that not only has economy been effected in recent years, but that the loss of life at sea is really and absolutely decreasing, although the volume of work is increasing. But one of the most important of all the papers was that by Mr. Flannery, Vice-President of the Institute of Marine Engineers, on vessels for the carriage of petroleum in bulk. The author discussed the comparative advantages of having the engines in these vessels amidships and aft. This paper, the work of a man with practical knowledge of his subject, and with the full belief of the possibilities of overcoming all difficulties in the way of making the carriage of petroleum innocuous by careful design and management, will be read with great interest. The Congress generally was a success, and we may feel sure that what promotes discussion of such matters as we have indicated between representatives of maritime nations tends to unity of treatment of important questions and therefore to the benefit of all.

SINCE we wrote a month ago on the terrible disaster to H.M.S. *Victoria*, many things that then appeared difficult have by fuller information become clear. We cannot yet discuss the points which are dealt with by the court-martial, but we are able to see that the deplorable loss of life which took place was due to the sudden, and of course unforeseen, speed with which the unfortunate battleship turned over. In such a case the ordinary rules and expectations formed by previous experience are set at nought, and we see the utter powerlessness of man to control the monster he has formed. Who is to blame for the actual occurrence will be settled by the court, but much larger and deeper questions are raised by the disaster. We must look to the design, to the armament, to the subdivision of our floating castles, we must ask ourselves whether the weapons and defences employed at sea in these days render it probable or even possible that future naval battles will be fought at close quarters as were the engagements of former days. If, as seems very likely, it is shown that until a combatant is disabled it will be a "game at long bowls," there will be a question as to the expediency of retaining the close formation of former days. It has already cost us the *Vanguard* and *Victoria*: it has cost the Germans the *Grosser Kurfurst*: it has cost both nations many precious lives. Cannot

we see that the lesson of all this is that whilst guns and armour—the offensive and defensive powers—have advanced: whilst speed and displacement—the powers of approaching and the difficulties of arresting the way of battleships—have increased in equal proportion—the cable's length of interval took formerly three times as long to cover as it does to-day—the difficulty of seeing an error and of averting its consequences have likewise increased in a similar ratio? The obvious inference seems to be that where two cables lengths, were allowed to a six-knot vessel weighing some three or four thousand tons, six is not an undue allowance where the vessels displace 14,000 tons, and the speed gets well into double figures. Fuller information has shown even more clearly the splendid bravery and quiet heroism of the *Victoria's* crew. Amongst the hundreds on board there is no suggestion of the presence of anyone who was unworthy of his place amongst them, and the nation by the magnificent total of the Mansion House Fund, closed at £50,000, subscribed in three weeks—has shown the country's appreciation. The contributions to that fund from the Colonies have shown too how close is their connection with the mother country, and how much they appreciate the protection of the white ensign.

At the International Maritime Congress of July, Prof. J. H. Biles contributed some useful information as to ocean passenger steamships. He comes to the conclusion that the increase of speed in ocean passenger steamers has not been made by sacrificing either safety or comfort, but on the contrary, it has been accompanied by a considerable increase of both these desirable qualities. The Professor endeavours to prove this conclusion by showing statistics that warrant the conclusion that the regularity of ocean passenger traffic tends to increase with the power and size of the vessels, and though the larger ships present more surface for the action of the sea, the increase of mass is in greater proportion. Further, all the improvements in machinery, which tend to lessen its weight, tend to increase the amount of power which can be employed in a given sized ship, so that we have not only the increase of size which makes increase of power possible, but we have also increase of power due to improvements in machinery. Both these increases of power tend, together with the natural increase of size, to make the modern ocean-going steamship more able to approximate to uniformity of speed and regularity of passage in spite of adverse weather and sea. By comparison with the average of ocean speeds throughout a year with fastest speed on any one voyage, it is shown that the largest vessel, of 3,600 tons displacement, only varies 5·6 per cent. during the year from its fastest speed, whilst smaller vessels of 5,200 and 4,800 tons respectively only, on their average make a speed of 12 and 19 per cent. less than their fastest speeds. In the Professor's opinion also the strength of the hulls of ocean-going steamers is for the present on the increase, as any weakness in a new design that is noted at sea is remedied in that vessel and in all sister ships by additional strength being given to that particular part of the structure; hence the result is, as time goes on, a gradual development of the fittest structure for the purpose, until some new and radical alterations of the structure are tried. Under the head of safety, the action of the Admiralty in encouraging owners of ocean liners to carry out subdivision into water-tight compartments has borne very great fruit since 1883. The motive for such subdivision supplied by the Admiralty, that such vessel should be able to float even with two compartments in communication with the sea, has led to structural alterations in which the shipowners seem to have heartily co-operated, so that to-day many passenger steamers fulfil this condition, and do not find their accommodation militated thereby. The subdivision of machinery for security against total breakdown has also followed that of subdivision into compartments, and now it is considered that no large steam vessel will be built without sub-division of engines and boilers between twin-screws, though it is probable that no high-speed ocean passenger vessel with two screws has attained as high an efficiency of propulsion as those with a single screw. It would therefore appear that in duplicating the engines and screws for safety, a practical limit has been reached, and there seems no strong reason for the adoption of triple screws in the immediate future, though the question is one that has been much ventilated. In protection from fire also the present system of subdivision has given much greater advantage, and if the openings or hatches in steel decks are properly constructed to resist fire an absolute safety is almost certainly obtained. General stability in modern steamships is well attended to, and the effect of bilge-keels to reduce rolling is now every day better recognised, whilst they do not seem to detract anything from the speed of a vessel in a sea-way. By the adoption too of forced draught, the air openings necessary for natural draught are much reduced, which gives much extra and valuable deck space, and the structure of the vessel is not so cut up, whilst the supply of air can be taken from enclosed spaces and thus effect ventilation as well as increase the evaporation of the boilers. Electricity is now largely applied for various purposes on board ship, and the advantages of power being transmitted through wires, instead of steam or water by pipes, appears to Professor Biles so

advantageous, that he believes that electricity will be for the future much more largely used on board ship for auxiliary purposes.

A. E. SEATON, C.E., also at this Congress gave an interesting historical account of the growth of steam communication with the Continent since a period of 40 years ago. Curiously enough, the Earle's Shipbuilding and Engineering Co., Limited, of Hull, who have lately had the building of one of the latest steamers for the new passenger traffic from Harwich to the Hook of Holland, commenced the trade 40 years ago by the first founders of their business building a vessel for the service between Hull and Holland. This first vessel was the screw-steamer *Minister Thorbecke*, of only 258 tons register and 60 N.H.P., and carried only 70 tons of cargo, and had plain accommodation in a deck house for eight passengers. She was employed between Hull and Harlingen, and her speed was about 8 knots per hour. This was a great contrast between the steamer just launched by the present company, the *Chelmsford*, of 1,635 tons register and 650 N.H.P., with triple-expansion engines, and a speed of over 18 knots an hour. Prior to the employment of steamships the trade was carried on chiefly by brigsfrom Hull and other North-East Coast ports. They carried about 400 to 500 tons of cargo, and but very scant and plain accommodation for a few passengers. The service was maintained, however, with a fair degree of regularity, the average sailings being about twice a week from a single port to a given destination. The sailing-ships were displaced by steam about 1840 to 1843, when the packets were chiefly paddle-wheel steamers. Mr. Seaton closely follows the further introduction of screw-steamers following that of paddle steamers, and their gradual increase in tonnage, speed, and passenger accommodation, which at first seems to have been very rude and quite a secondary consideration to their cargo capacity. The experiments with the *Bessemer* and its hanging saloon the *Castalia* with its twin hulls, and the later *Calais-Douvre*, are all described in the details of the competition of the various Railway Co.'s to secure the South Coast Continental traffic. The old *Baron Osy*, whose excellent accommodation for passengers between the port of London and Antwerp we have many times had the pleasure of personally testing, is not forgotten, and the latest achievement in fast passenger and mail steamers by the London, Chatham and Dover, Great Eastern, South Eastern, and London, Brighton and South Coast Railways are carefully described and commented upon.

DR. ELGAR'S paper, read at the Summer Meeting of the Institution of Naval Architects, might at first sight give some cause for amusement that a dead and buried theme such as that of the *Great Eastern* should be deemed of interest to an Institute which represents all that is up to date in naval construction. But on careful consideration of the matter submitted by Dr. Elgar, no one can withhold sympathy and appreciation from the efforts of one of the leading lights of naval architecture to point out to posterity the high order of genius in the light of the then knowledge, which was evinced by the constructor and engineer of the *Great Eastern* (Mr. J. Scott Russell and Mr. I. Brunel). To do this in the most magnanimous way Dr. Elgar actually institutes a direct comparison between the *Great Eastern* of 1853, and one of the highest examples of successful modern construction in the *Campania*, and as good as says that all the leading principles of our present greatest triumphs were at least foreshadowed in the *Great Eastern*, which has usually been considered as a name synonymous with disaster and financial loss. In fine, on Dr. Elgar's authority, "the *Grea Eastern* is the most wonderful instance the world has seen of attempts to obtain high speed over long distances at sea." This statement is ably supported by comparison of the then accomplished facts in naval architecture. The magnitude of the stride then effected in naval construction was as great as would be now involved by the construction of a ship 1,200 ft. long and of 30 to 35 knots speed. That is, the *Great Eastern* was a novel design, doubling the length of any known vessel then afloat, and with an accomplished increase of speed on any steamships then extant of 50 per cent. The general dimensions and principles of design are ridiculously like those of the *Campania*, and would have been more so had not the design of the *Campania* been purposely distorted to keep her draught to a maximum of 27 ft., and to lighten her structure by the erection of a promenade deck and shade deck, instead of her upper works being continued as a flush deck, which would at any rate have given greater strength and stiffness to her hull. The main feature in the construction of the hulls of the *Campania* and *Great Eastern* are wonderfully alike when the great lapse of time between their relative construction is considered. There are several complete iron or steel decks, the upper one being of great strength, forming the upper member of a great girder, the lower member of which in both cases is the double cellular bottom. The plates of the *Great Eastern* are three-quarters of an inch in thickness as against seven-eighths of an inch in the *Campania*. The *Campania* has two distinct sets of propelling machinery driving twin screws for safety against complete break-down. The *Great Eastern* had also two complete sets of driving machinery, one driving the

paddle wheel and the other the single screw. There are 13 boilers in the *Campania* with 100 furnaces, whilst in the *Great Eastern* there are 10 boilers with 112 furnaces. The *Great Eastern*, when in her prime, realised her estimated speed of 14 to 15 knots per hour as against a known average at that time of about 10 knots, therefore the present principles which are now seeing development in larger speeds obtained from vessels of increased tonnage with large coal carrying capacity were fully anticipated in the design and construction of the *Great Eastern*. The great improvements in marine construction since 1853 have been in the marine engineering department, for whereas the *Great Eastern* carried engines and boilers with register tonnage gross of nearly 19,000 tons to develop only 8,000 I.H.P., the *Campania* with a gross tonnage of only 13,000 tons carries engines and boilers to develop 30,000 I.H.P. with not more than the same consumption of fuel than that of the *Great Eastern*. As a matter of fact, the *Great Eastern* was a failure commercially, but chiefly because she was before her market, and could not be utilised for ordinary passenger or cargo traffic unless as one of a fleet of similar vessels, giving regular and frequent departures, and until the traffic was large enough, as at the present day, to maintain so enormous a regular traffic. All honour should be given to such an audacious, and in a mechanical and naval sense, successful experiment, and all honour to the Vice-President of the Institution of Naval Architects, who will in the course of modern success go out of his way chivalrously to draw our attention to the genius, audacity, and comparative success in their day, of dead and gone scientific progenitors.

SOME EXPERIMENTS ON THE COMBINATION OF INDUCED DRAUGHT AND HOT AIR, APPLIED TO MARINE BOILERS FITTED WITH "SERVE" TUBES AND RETARDERS.*

By J. D. ELLIS, Esq., Managing Director Messrs. John Brown & Co., Limited, Sheffield.

In these days of triple and quadruple expansion engines and high speed for ships, I trust some remarks and results of experiments on the economical and efficient production of steam for marine boilers will not be uninteresting to the members of this Institution.

The combined use of strong artificial suction draught "Serve" tubes, and retarders, and further utilising the heat of the gases when they have left the boiler, seem to me the natural outcome of the requirements of the day.

The engine-power demanded by the present ships has advanced by leaps and bounds, and two of the latest built have reached a power of over 30,000 I.H.P. each. It has therefore become an urgent necessity to obtain more work per cubic foot of boiler than hitherto, not only without loss, but, if possible, with a gain of economy.

The height of smokestacks for natural draught has increased with the increase in the size of the ships, and thus a vacuum of about half an inch of water has been reached, being nearly twice as much as had been obtained only three or four years ago in the great majority of vessels with natural draught. In other vessels the draught has been artificially increased by blowing air into an open or closed stokehold or closed furnace. Mr. Martin has worked in the direction of exhausting the gases by fans in the funnel, instead of forcing the air into the boilers. Jets of steam or compressed air in the funnel have been tried to obtain an increase of draught. Mr. Howden has, in addition to his forced draught, utilised some of the heat of the waste gases by heating the air, making it pass round a nest of short vertical tubes through which the waste gases go from the smoke-box to the funnel. In other cases the air has been heated slightly by the heat which would otherwise have been lost by radiation. Retarders have been used by Mr. Howden in plain tubes with forced draught to bring the swiftly passing gases into better contact with the heat-absorbing surface, and have thereby, as well as to some extent by radiation, been a source of economy.

The advent of the "Serve" tubes has marked another important era in the history of boilers. The heat-absorbing surface of the "Serve" tube is much greater than that of a plain tube of the same outside diameter, and a retarder placed in the centre of the "Serve" tubes makes, for a draught of three-quarters of an inch and over of water pressure or vacuum, the most efficient and economical combination I know at present.

Having ascertained in ordinary single-ended Scotch marine boilers the value of the "Serve" tube and of the retarder with different rates of draught, with Martin's induced draught with cold air, and Howden's forced draught with heated air, it seemed to me that a considerable improvement was possible over existing practice by combining and extending the best features of the various systems, and the accompanying drawing No. 1 shows this combination as it has been at work in boilers Nos. 7 and 8 for over twelve months at the Atlas Works.

I have preferred artificial "suction" draught to "forced" draught, because it seemed the natural way of increasing the efficiency, being "natural" draught intensified, produced by artificial means, merely because the equivalent height of smoke-stack cannot be used at sea. Seeing that in any case, whether the draught be suction or forced, a given quantity of air must pass through the boiler at a certain speed to produce a given combustion, and being of opinion that suction draught was less likely to produce trouble in the combustion chamber than forced draught at the high rate of combustion I had in view, the best means applicable at sea of obtaining this kind of draught had to be considered. Steam jets in the funnel could not be entertained because of the loss of the water. Air jets were doubtful. Fans had been tried for exhausting the gases, and the heat had given trouble even when burning at rates far below those intended by me, or to avoid the gases passing into the fans at a high temperature, the tubes had to be made very small in diameter, therefore liable to choke readily, and reducing greatly the amount of coal which could be burnt with a given rate of draught compared with ordinary sized tubes. Besides this the crowded tubes impeded circulation within the boiler. I knew the "Serve" tubes and retarders would reduce the heat of the gases appreciably within the boiler itself; but, as I desired to burn at the rate of 45 lbs. to 60 lbs. per square foot of full-size grate, therefore three or four times the rate of ordinary natural draught, the temperature of the gases escaping from the boiler into the smoke box would still be high, and required to be further absorbed for the double purpose of preventing difficulty with the fans and increasing the efficiency per pound of fuel. A nest of short vertical air-heating tubes, as in the Howden system, would do good, but I desired something more, because I wished to burn at a higher rate. Thus I came to horizontal tubes, which are more effective than vertical ones, and which can be used of greater length. The ultimate combination and extension is shown in drawing No. 1, the leading features of the boiler being therefore—

(1) Suction or induced draught.

(2) The utilisation of the waste gases for heating the air before it passes into the furnace.

(3) "Serve" tubes.

(4) Retarders in the tubes.

* Read at the Summer Meeting at Cardiff, of the Thirty-fourth Session of the Institution of Naval Architects, July 12th, 1893; Lord Brassey, K.C.B., in the Chair.

The principal dimensions of the boilers are as follow :—

BOILER.	Diameter of boilers	10 ft. 6in.
	Length of boilers	10 ft. 6 in.
	"Purves" flues in each boiler ..	2
	Inside diameter of flue	2 ft. 10½ in.
	Length of furnaces..	7 ft. 6½ in.
	Total number of tubes ("Serve")	118
	Outside diameter of tubes	3¼ in.
	Thickness of ordinary tubes ..	·116 in.
	Number of stay tubes	44
	Thickness of stay tubes	·144 in.
	Pitch of tubes from centre to centre	4¾ in.
	Total heat-absorbing surface of tubes	1303·6 sq. ft.
	Heat-distributing surface of tubes	741 "
	Heat-distributing surface of furnaces	75 "
	Heat-distributing surface of combustion chambers	95 "
	Total heat-distributing surface per boiler	911 "
	Area of grate surface	32 "
	Length of grate	5 ft. 8 in.
	Bars, 3 in. deep. ¾ in. thick, and ⅝ in. air space.	
	Proportion of grate to hold heating surface	1 to 28·4
AIR-HEATING BOXES.	In the heat-absorbing chambers there are	80 tubes (pl.)
	Diameter of tubes outside	3 in.
	Length of tubes	14 ft. 4 in.
	Thickness of tubes	·116 in.
	Total heat-absorbing surface ..	900 sq. ft.
FANS AND ENGINES.	Fan to each boiler	1
	Diameter of fan over tips of blades	5 ft. 6 in.
	Width of fan	1 ft. 9 in.
	Diameter of engine cylinders (two cylinders)	7 in.
	Stroke	5 in.

It will be seen that the boiler itself is an ordinary single-ended Scotch type marine boiler, with "Purves" furnaces and "Serve" tubes. The combustion chamber is fairly large for the size of boiler. The tubes, 3¼ in., outside diameter, are spaced somewhat further apart than is customary now, and good circulation of water and ready escape of steam are thereby facilitated. In selecting so large a diameter of tubes—instead of the usual small diameters—for high rates of combustion, I was not concerned as to the amount of heat-"distributing" surface within the boiler, and this finally came out at the proportion of 28·4 square feet to one square foot of grate surface. Small plain tubes have been necessary previously for the sake of obtaining the utmost heat-absorbing surface; but by using the "Serve" type of tube, I obtained much more heat-absorbing surface with the smaller number of 3¼ in. tubes widely spaced, than could be done with a large number of small diameter plain tubes closely pitched. The advantages are obvious. Increased section for the passage of the gases; increased heat-absorbing surface, and better circulation of the water and escape of steam. Events have proved that in these boilers prolonged evaporation can take place, without trouble, and from cold feed, at unprecedented rates for this class of boiler.

The grate is in two lengths—the bars are ordinary wrought-iron bars, 2 ft. 10 in. long by 3 in. deep, ¾ in. thick at top by ½ in. at bottom, spaced ⅝ in. apart. The only departure from ordinary practice is that the grate for high rates of combustion, say, over 35 lbs., rises towards the back (2 in. in 5 ft. 8 in. total length), instead of falling about 2 in. as is usual. Up to 35 lbs. per square foot the grate may be horizontal. I did not arrive at this conclusion without considerable experiment. At one time it seemed as if I should require to have recourse to a tubular grate with air or water passing through the same; but, realising the objections to such grates, I persevered, after having repeatedly burnt down in half an hour a new wrought-iron grate composed of bars as above, sloping downwards. The gradual raising of the back end to 2 in. above front end has resulted in our being entirely relieved of all anxiety as to the grate, even when burning at 60 lbs. per square foot.

For convenience of admission of the air in proper quantities above or below the grate, I use the cast-iron mouthpieces introduced by Mr. Howden, and have modified them to my requirements. The Howden mouthpiece has one valve over the fire, and two at the side for the air to pass under the grate. I have added two valves over the fire, as I found the usual practice gave incomplete combustion with certain classes of coal, because it did not admit sufficient air over the grate. In our boilers the three top valves are wide open, and two side valves shut, for smoky coal, and *vice versa* for non-smoky coal. A number of small holes in the bottom furnace doors allow a certain quantity of cold air to be drawn in under the grate, and it is only the heated air which is put sometimes over, sometimes under the grate, according to the nature of the coal. Thus we have found every sort of coal can be burnt with economy without smoke.

The accompanying tables of experiments give the results of various classes of coal, moderate and high rates of combustion, short and long trials, and grates cleaned at great and smaller intervals. These results, I trust, are indivually and collectively interesting. I have endeavoured to eliminate all circumstances which might make the results doubtful. For experiments, the water is taken from tanks made of castiron plates planed to template. The inside dimensions are 4 ft. 5 in. by 4 ft. 4½ in. by 9 ft. high. One inch depth of water equals ten gallons = 100 lbs. The quantity pumped into the boilers can be read off at any time by the scaled gauge glasses. The coal is weighed out carefully as the trials proceed. Mercury thermometers are used for temperatures to 600° F. Only one indication needs the means of measuring a higher temperature, viz., the smokebox. For this we use now metals of which the melting-point is well known, in preference to any kind of pyrometers. The trials commence with the fires burnt down to a minimum, and finish, as near as possible, with the same height of fire and same condition. The tables show how the temperature of the gases is greatly reduced before they reach the fans, and the heat utilised by the high temperature of the air, and the satisfactory evaporation per pound of coal.

Leaky tube-ends are unknown, and coke-nests have been found to occur only with coal from certain mines. The heat-distributing surfaces evidently do their work well, one square foot of heating surface having evaporated as much as 16·8 lbs. of cold water (70°) per hour (see test No. 4) with Scotch coal for seven hours without cleaning the grate, averaging a combustion of 59·54 lbs. per square foot of grate over the whole period.

In our experiments we have already used South Wales, Newcastle, South Yorkshire, Scotch, Lancashire, Pennsylvanian, and Australian coal, and it is intended to continue the experiments until all the different kinds principally used in our Mercantile Navy have been tried, and the comparative results ascertained.

I am well aware that these experiments have been made on land, and with a comparatively low pressure of steam, but I am unable to see any sufficient reason why similar advantages and results should not be obtained at sea, if the system be adopted, provided care is taken to keep the boilers reasonably free from oil and solid matter. One ship thus fitted is working satisfactorily and several others will be running shortly.

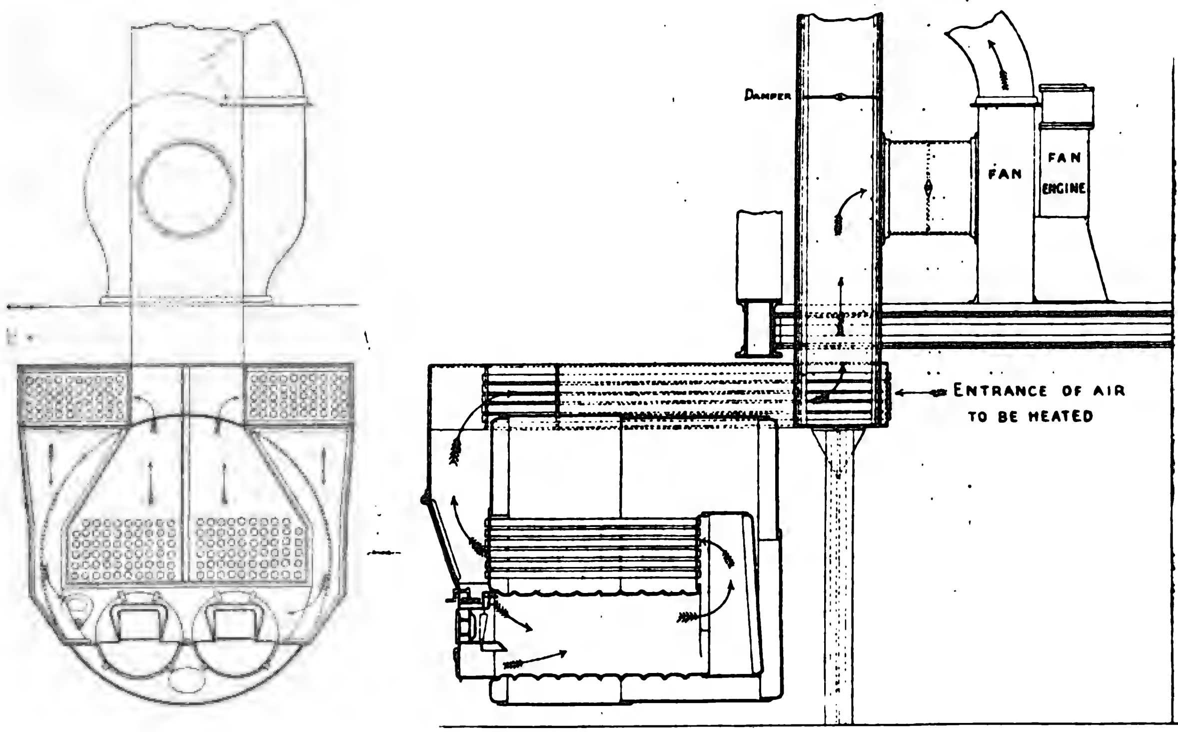
Besides the principal advantages of high evaporation with economy and safety, thereby reducing the number of boilers (consequently the boiler space and weight hitherto required), the following further advantages appear to me not unimportant:—

- Cool stokehold or engine-room, if the air supply is taken from the latter instead of the atmosphere.
- Clean stokehold, the coal-dust being sucked into the boilers.
- Absence of risk of burns to firemen, the flame at all times being sucked away from them.
- Convenience to firemen, there being no valves to shut or open, when opening or closing the doors.
- Smoke with unskilful firing is greatly reduced, and with careful firing need not occur at all, with any kind of coal.
- Great elasticity of power under ready control.
- Greatly reduced quantity of clinker and residue.

In making these results of the combination public, I desire to express my indebtedness to the eminent French engineer, Mr. J. Serve, for his valuable suggestions, and to the staff at the Atlas Works.

Mr. Fothergill, who opened the discussion, after paying a compliment to the writer of the paper, said he had on many occasions expressed the view that some form of mechanical draught was the thing of the future. When they had broken down the strong

prejudices against forced draught, and it was better understood, they would have surmounted many of the very great difficulties of the present—that was as opposed to its use. In his experience, which had extended over 9 or 10 years, the greatest difficulty had been with the firemen. Where they had forced draught they needed steady and regular firing, and they could not get the stokers to do it; the men would fire tco heavily. When they got in the Navy they had discipline, and it was different. He could not altogether agree with Mr. Ellis about heating the air. He thought there was some misunderstanding as to the value and advantage got from heating the air. Every unit of heat returned to the furnace was a unit gained, and nothing more. If they could not put sufficient tubes into the boiler to absorb the heat, he thought they were not getting economy in letting that heat go through the boiler and absorbing it by boxes of air tubes. Some experiments were carried out by Mr. Spence at Mr. Marshall's works, where several pipes were so arranged and heated by a coke fire. There was no question as to the temperature being affected by radiation. When the air was heated to 261 deg. the only gain in economy due to that fact was ·68. Mr. Ellis had put up a costly apparatus to get his results, and he (the speaker) was still of opinion that the game was not worth the candle. It had appeared to him that it would be much better if they could fix up some apparatus to heat the feed water, because the specific heat of water was more than four times that of air. In dealing with heated air, if they increased the temperature to 450 deg. they doubled the volume, with the result, he took it, that they doubled the capacity of the fans and doubled the power required to drive the fans, and that was a serious matter. The point on which Mr. Ellis could be congratulated was the large quantity of coal he was burning per square foot of grate. He thought that was a great achievement. The *Iona* was a steamer under his (the speaker's) own supervision, and she had been fitted with his own arrangement of forced draught. Experimental tests had been made of his system by a committee of the Institution of Mechanical Engineers under Professor Kennedy, and they got with cold air and nothing specially erected, results which corroborated his statement that the heating of the air was not by any means so economical as urged by Mr. Ellis. However, it was all very well in experiments to get results, but when they came to ordinary practice they found they were altogether different. He would like Mr. Ellis to give them the results of tests with a steamer that had been run for some period under ordinary conditions with ordinary tubes, and then fitted and run with Serve tubes, not for one voyage only but for 12 months.



Mr. Marshall personally added his thanks to the reader of the paper. That forced draught was a thing of the future there could not be a doubt. George Stevenson saw that many years ago, and he introduced it on his locomotives, and made them a success. Mr. Ellis was following in his direction, because he adopted induced draught as George Stevenson did. Whether Mr. Ellis's means of doing it were the best remained to be seen. There could be no doubt that Mr. Ellis's views were in the right direction. They had carried out experiments in their works some years ago, and had gained 6·8 in heating the air. At that time they knew very little about the question, and they had it all to open up. The experiments were carried out to find what could be gained by heating the air. He was afraid that in Mr. Ellis's scheme there would be loss in the retardation of the gases by the tubes, which turned and twisted about so much before the gases could pass into the funnel. But when Mr. Ellis got his system more perfected he had no doubt that that would be rectified. The question of the retardation of the gases was a serious one.

Mr. J. T. Milton said he was unprepared to discuss fully the valuable paper which they had heard from Mr. Ellis. He had had the opportunity of seeing some of the experiments made at Messrs. Brown's works, and so far as the words which had fallen from Mr. Fothergill might lead to a misimpression, he (the speaker) could add his testimony to the great accuracy with which those experiments were made. The figures could actually be relied upon. The whole question seemed to be to him one of economy. Mr. Ellis had adopted practically a compound boiler, with a view of obtaining economy. If they examined his figures they found that the total boiler surface was 911 square feet, and he supplemented that with 900 feet in his air-heating boxes. For the sake of getting the last element of heat out of the combustion he had had to add another boiler so far as surfaces were concerned. Whether that extra 900 feet could not have been more profitably employed by heating the feed water, as Mr. Fothergill had suggested, was an open question. There was another point which they must bear in mind. Mr. Ellis's results were gained mainly by the perfect combustion of coal. He told them that he put a good deal of air above the fire grate, and in that he (the speaker) believed lay the whole secret of the suc-

cess attained. The experiments made at Mr. Marshall's place showed the importance of admitting air above the grate when burning north country coal.

Mr. W. H. White said that through illness his colleague the Engineer-in-Chief to the Navy (Mr. Durston) was unable to be present to speak on this question. He regretted that very much, because Mr. Durston had had great experience in the matter. Some months ago Mr. Ellis gave him (Mr. White) the opportunity of seeing the apparatus at work at the Atlas Works. No one could witness the experiments without seeing the beauty of the arrangements. It occurred to him that the Institution would be benefited by Mr. Ellis's experience, and he succeeded in overcoming Mr. Ellis's modesty and persuaded him to read this paper. In looking at the working of the boilers at the Atlas Works, it struck him that there were conditions there which would never be so favourable at sea. In looking through the tables given by Mr. Ellis it was necessary to remember that the conditions would be different on a vessel at sea. He should like Mr. Ellis to give them —if he were at liberty to do so—the general conclusions which he had arrived at from the experience they had gained by this means on board ship. The Admiralty had made extensive trials with induced draught—induced draught on Mr. Martin's system. These trials were made in strict comparison with forced draught. They were first carried out on a locomotive boiler, and more recently repeated in a torpedo boat at Chatham, one stokehole being worked on the ordinary system of forced draught, and the other under an induced draught. These experiments were not complete, but so far as they had gone they did not bear out the advantages for induced draught over forced draught which Mr. Ellis's trials had led him to think were gained. There was always danger with artificial draught if tube ends leaked, and he did not think there was any great advantage in induced over forced draught in this particular. The French Navy had tried forced and induced draught (induced by jets in the funnel), but they had gone back to the old system of forced draught. Personally he ventured to think that Mr. Ellis might get all the results he was expecting. They would have rival and alternative systems, each tending by competition to improve the other.

Mr. S. H. Terry regretted that Mr. Ellis had not given the volume of air passing through the furnace, so that information might be obtained as to the quantity used per pound of coal burnt. The omission was doubtless due to the difficulty of measuring air currents. The point of great importance in trials of this nature was to ascertain the volume of air passing to the chimney. Every additional foot of air supplied to the furnace over that necessary, carried away heat without doing a corresponding good amount of work. With regard to the induced draught system, he would point out that if the fan were put in the funnel, where it had to deal with the products of combustion and escaping gases, it would have a larger volume to act upon than in the case of dealing with cold air only. There was, however, more than this in the fact, for the fan acted on the principle of centrifugal force, so that the factor of weight was an important one. If the air were doubled in volume, its specific gravity would be decreased, and the circumstance would have an important bearing on the working. The point was one of considerable importance, especially on shipboard, where weight and space were necessarily confined by the limits of the situation.

Mr. Bevis said he had not heard anything said on the advantage of reducing the temperature of the escaping gases so as to enable the fans to work. With the great additional weight of Mr. Ellis's system, would it not be better to use that weight in the ordinary form of boiler?

Mr. Gross, who had been connected with the author in his experiments, said that Mr. Fothergill had spoken as one might expect from the fact that he had not seen the boilers: if he had, he would not have made many of the remarks that occurred in his speech. The apparatus, as described, had been at work at sea in one ship, and the results obtained closely approximated to those given by the author. With regard to Mr. Bevis's remarks, he thought, on the figures given in the paper, that the extra cost involved in the fitting of the apparatus was more than paid for.

TABLE I.

Results of Experiments made with "Serve" Tubes and Induced Hot-air Feed on August 23 to 27, 29 to 30, September 1 to 2, 2 to 3, 1892, Atlas Works, Sheffield.

Nos. 7 and 8 Marine Boilers. "Serve" Tubes with Retarders and Induced Hot-air Feed.

Date.	Duration of trial, in hours.	Total coal burnt, in lbs.	Coal burnt per hour, in lbs.	Fuel used.	Total water evaporated, in lbs.	Water evaporated per hour, in lbs.	Lbs. of water per lb. of coal evaporated at actual temperature of feed.	Lbs. of water evaporated per lb. of coal, from and at 212°.	Lbs. of coal burnt per square foot of grate per hour.	Temperature of air at side valves, Fahrenheit.	Temperature of gases at base of chimney, Fahrenheit.	Temperature of gases in smokebox, Fahrenheit.	Vacuum under grate bars.	Vacuum over fires.	Vacuum at base of chimney, in inches, of water.	Vacuum above outlet of fan.	Speed of air under grate bars, in feet, per minute.	Average temperature of feed water.	Average steam-boiler pressure per square inch.	Revolutions of fan and engine per minute.	Air spaces in grate.	Thickness of bars.	Lbs. of water per square foot of heat-distributing surface per hour.
1892.										deg.	deg.	deg.	in.	in.	in.		ft.	deg.	lbs.		in.	in.	
Aug. 23 to 27	96	123,648	1,288	Yorkshire.	1,102,800	11,487·5	8·91	10·29	40·25	263	393	656	—	·43	4·68	—	1,207	87	44	541	[illegible]	[illegible]	12·6
Aug. 29 to 30	24	34,552	1,439·6		303,700	12,654·1	8·78	10·24	44·98	305	386	653	—	·39	3·37	—	1,451	76	46	463	[illegible]	[illegible]	13·89
Sep. 1 to 2..	24	32,805	1,366·8		295,500	12,312·5	9·00	10·45	42·71	262	386	618	·77	1·16	4·56	—	—	81	45	525	[illegible]	[illegible]	13 51
Sep. 2 to 3..	24	32,928	1,372		297,000	12,375	9·10	10·48	42·87	294	391	692	·65	·72	5·05	—	—	79	45	571	[illegible]	[illegible]	13·58

August 23 to 27.—In this experiment all bars were cleaned and tubes swept before starting; fires were cleaned every twelve hours alternately; the tubes were not swept during the whole of this trial. In this test all hot air was passed above the fires, and cold air underneath, the bottom doors being half open to allow admittance of cold air.

August 29 to 30.—In this experiment new fire bars were put in, and tubes swept before starting; fires were cleaned every four hours; the tubes were not swept during the whole of this trial. In this test all hot air was passed above the fires, and cold air underneath, the bottom doors being half open to allow admittance of cold air.

September 1 to 2.—In this experiment all bars were cleaned and tubes swept before starting; fires were cleaned every six hours; the tubes were not swept during the whole of this trial. In this test the hot-air feed was both top and bottom, but underneath the bars the hot air was diluted with cold air being admitted through seventy holes in each ashpit door; there was also a second perforated plate behind the ashpit door, for the purpose of mixing the air thoroughly. The temperature of air under grate was an average of about 150° Fahrenheit.

September 2 to 3.—In this experiment all bars were cleaned and tubes swept before starting; fires cleaned every six hours; the tubes were not swept during the whole of this trial. In this test all hot air was passed above the fires, and cold air underneath; the bottom doors being shut, the cold air passed through seventy holes drilled in each door for the purpose; area of these holes, 124 square inches, i.e., 62 square inches in each door; area for passage of air over both fires—220 square inches.

TABLE II.

RESULTS OF EXPERIMENTS MADE WITH "SERVE" TUBES AND INDUCED HOT-AIR FEED ON AUGUST 15, AND NOVEMBER 5, 8, 15, 17, AND 18, 1892, ATLAS WORKS, SHEFFIELD.

Nos. 7 AND 8 MARINE BOILERS. "SERVE" TUBES WITH RETARDERS AND INDUCED HOT-AIR FEED.

Date.	Duration of trial, in hours.	Total coal burnt, in lbs.	Coal burnt per hour, in lbs.	Fuel	Total water evaporated, in lbs.	Water evaporated per hour, in lbs.	Lbs. of water evaporated per lb. of coal at actual temperature of feed.	Lbs. of water evaporated per lb. of coal, from and at 212°.	Lbs. of coal burnt per square foot of grate bar per hour.	Temperature of air at side valves, Fahrenheit.	Temperature of gases at base of chimney Fahrenheit.	Temperature of gases in smokebox, Fahrenheit.	Vacuum under grate bars.	Vacuum over fires.	Vacuum at base of chimney, in inches, of water.	Vacuum above outlet of fan.	Speed of air under grate bars, in feet, per minute.	Speed of air through heating tubes, in feet, per minute.	Temperature of air entering heating tubes, Fahrenheit.	Average temperature of feed water, Fahrenheit.	Average steam-boiler pressure in lbs. per square inch.	Revolutions of fan and engine per minute.	Grate bars. Air space.	Grate bars. Thickness of bars.	Lbs. of water per square foot of heat-distributing surface per hour
1892.										deg.	deg.		in.	in.	in.	in.		ft.	deg.	deg.				in.	
Nov. 5..	4	4,909	1,242·25	American	47,550	11,887·5	9·56	11·28	38·82	307	380	Melted Lead	—	·5	4·08	·25	1,902	486	85	65	49	505	Front ⅝ in. Back ⅜ in.	⅝	13·04
,, 15..	7½	8,018	1,069·06	American	72,500	9,666·66	9 04	10·63	33·4	246	331	,,	·88	1·2	4·35	·36	2,176	1,249	66	66	45	498	in. ½	½	10·61
,, 17..	5	5,632	1,126·4	American	52,600	10,520	9·33	11·02	35·2	246	336	,,	·91	1·27	4·37	·35	2,404	1,220	51	59	43	490	½	½	11·54
Aug. 15..	7	7,443	1,063·28	Nixon's Navigation	68,900	9,842·85	9·25	10·88	33·22	200	290	442 deg.	1·07	1·64	2·65	—	—	—	—	72	45	382	⅝	⅝	10·8
Nov. 8..	48	67,268	1,401·41	Nixon's Navigation	599,700	12,493·75	8·91	10·5	43·79	311	442	Melted Zinc.	—	·62	6·13	·33	1,319	508	64	66	49	634	⅝	⅝	13·71
,, 18..	7	10,192	1,456	Nixon's Navigation	99,300	14,185·71	9 74	11·44	45·5	265	374	,,	·78	1·3	4·87	·36	2,658	1,141	57	67	45	548	½	½	15·57

REMARKS.—In these experiments with Welsh and American coal, the best results were obtained by putting all the hot air under the grate with the ashpit doors closed, the hot air being diluted by the cold air being admitted through the holes in ashpit doors. Fires kept a moderate thickness. During the 48 hours' test the mode of admitting the air was tried in various ways, but the best results were obtained as above stated. This experimenting with the valves accounts for the apparently low evaporation. The fire bars in this test were partly cleaned every 8 hours; but in the others they were not cleaned during the whole of the tests. Melting point of lead 630 degrees Fahrenheit, of zinc 700 degrees Fahrenheit.

TABLE III.

RESULTS OF EXPERIMENTS MADE WITH "SERVE" TUBES AND INDUCED HOT-AIR FEED ON FEBRUARY 24, 27, AND MARCH 15, 1893, ATLAS WORKS, SHEFFIELD.

No. 7 MARINE BOILER. "SERVE" TUBES WITH RETARDERS AND INDUCED HOT-AIR FEED.

Date.	Duration of trial, in hours.	Total coal burnt, in lbs.	Coal burnt per hour, in lbs.	Fuel used.	Total water evaporated, in lbs.	Water evaporated per hour, in lbs.	Lbs. of water evaporated per lb. of coal at actual temperature of feed water.	Lbs. of water evaporated per lb. of coal, from and at 212°.	Lbs. of coal burnt per square foot of grate bar per hour.	Temperature of air at side valves, Fahrenheit.	Temperature of gases at base of chimney, Fahrenheit.	Temperature of gases in smokebox, Fahrenheit.	Vacuum under grate bars.	Vacuum over fires.	Vacuum at base of chimney, in inches, of water.	Vacuum above outlet of fan.	Speed of air under grate bars, in feet, per minute.	Speed of air through heating tubes, in feet, per minute.	Temperature of air entering heating tubes, Fahrenheit.	Average temperature of feed water, Fahrenheit.	Average steam-boiler pressure, in lbs. per square inch.	Revolutions of fan and engine.	Grate bars. Air space.	Grate bars. Thickness of bars.	Lbs. of water per square foot of heat-distributing surface, per hour.
1893.										deg.	deg.		in.	in.	in.	in.			deg.	deg.			in.	in.	
Feb. 24..	7	9,632	1,376	Newcastle.	88,100	12,585·71	9·14	10 81	43	279	408	Melted Bismuth.	1·01	1·17	5·06	·375	2,464	1,167	61	61	47	573	⅝	⅝	13·81
,, 27..	7	10,304	1,472	Newcastle.	96,600	13,800	9 37	11·18	46	281	392	,,	·93	1·24	4 62	·375	2,098	1,332	61	50	47	510	⅝	⅝	15·14
Mar. 15..	7	10,192	1,456	Newcastle.	92,300	13,185·71	9·05	10 66	45 5	276	390	Melted Lead.	1·25	1·57	5·42	·375	2,586	1,570	65	66	49	567	⅝	⅝	14·47

REMARKS.—February 24: In this experiment all the hot air was passed above the fires, and cold air underneath, the bottom doors being shut, the cold air passed through 70 holes drilled in each door for the purpose. February 27 and March 15: In these experiments all the hot air was passed under the fires, but was diluted with cold air, admitted through 70 holes in each ashpit door In the above experiments the fire bars were cleaned and tubes swept before starting. The fire bars were not cleaned again during the whole of the 7 hours' test. Melting point of bismuth, 493 degrees Fahrenheit; of lead, 630 degrees Fahrenheit.

TABLE IV.

RESULTS OF EXPERIMENTS MADE WITH "SERVE" TUBES AND INDUCED HOT-AIR FEED, MAY 5 AND 8, 1893, ATLAS WORKS, SHEFFIELD.

No. 7 MARINE BOILER. "SERVE" TUBES WITH RETARDERS AND INDUCED HOT-AIR FEED.

Date.	Duration of trial, in hours.	Total coal burnt, in lbs.	Coal burnt per hour, in lbs.	Fuel used.	Total water evaporated, in lbs.	Water evaporated per hour, in lbs.	Lbs. of water evaporated per lb. of coal at actual temperature of feed.	Lbs. of water evaporated per lb. of coal, from and at 212°.	Lbs. of coal burnt per square foot of grate bar per hour.	Temperature of air at side valves, Fahrenheit.	Temperature of gases at base of chimney, Fahrenheit.	Temperature of gases in smokebox, Fahrenheit.	Vacuum under grate bars.	Vacuum over fire.	Vacuum at base of chimney, in inches, of water.	Vacuum above outlet of fan.	Speed of air under grate bars, in feet, per minute.	Speed of air through heating tubes, in feet, per minute.	Temperature of air entering heating tubes, Fahrenheit.	Average temperature of feed water, Fahrenheit.	Average steam-boiler pressure, in lbs. per square inch.	Revolutions of fan and engine per minute.	Grate bars. Air space.	Grate bars. Thickness of bars.	Lbs. of water per square foot of heat-distributing surface per hour.
1893.										deg.	deg.		in.	in.	in.	in.			deg.	deg.			in.	in.	
May 5 ..	7	11,228	1,604	Scotch Coal.	91,600	13,085 71	8·15	9·46	50·12	300	416	Melted Lead	·99	1·22	4 58	·375	2,445	1,150	83	82	46·6	542	⅝	⅝	14·36
,, 8 ..	7	13,293	1,899	Scotch Coal.	107,900	15,314·2	8·06	9·45	59·34	293	434	,,	·93	1·26	4·58	·375	1,981	1,448	83	70	46	544	⅝	⅝	16·81

REMARKS.—MAY 5, 1893: In the 7 hours' run the fires were not cleaned for the whole of the 7 hours. The fires were kept very thick, and all the hot air put on top of fire, the cold air only being admitted under grate May 8, 1893: In this test of Scotch coal, the bars were again not cleaned during the whole of the run, but the fires were very thin, and the whole of the air, both heated and cold, was passed under the grate. The results were, it will be seen, much better even than on May 5. Melting point of lead, 630 degrees Fahrenheit.

It appeared to him that the speaker had not sufficiently taken into consideration the economy which they had obtained. A remark had been made as to the difference between heat-absorbing and heat-distributing surfaces, but the former might be taken as the true factor in calculations, for they found by experience that if they could get the heat into the metal of the tubes it would be sure to be taken up by the water; in fact, if they could get a large area of heat-absorbing surface, the heat-distributing surface would take care of itself, provided always that it was clean. The late Dr. Kirk had reported on the system, and he had said that at the Atlas Works the same results had been obtained as in those recorded in the case of the *Iona's* trials, although but half the amount of coal was burnt per square foot of heating surface in the latter case, as compared to that consumed at the Atlas Works. That was taking the heat-distributing surface to calculate from in the case of the Serve tubes. It might be objected that this was not a fair comparison, but the speaker would point out that the additional surface acquired by the use of the ribs in the Serve tubes did not involve the same addition to weight as would be the case if the heating surface were enlarged in the more ordinary way. Reference had been made by one speaker to the area through the tubes being small, but he preferred the use of fewer tubes, putting them farther apart, so as not to check the natural convexion of the water when heated. In spite of the fewer tubes, however, they obtained more area than was absolutely needed. With regard to what Dr. White had said on the air supply to the stokehold, and the effect of tortuous passages in checking the draught, he could say that they had had one ship running on the Atlantic since March 1, in which the system was fitted, and it was said that her stokehold was the coldest on the Atlantic. (Dr. White explained that he did not question the possibility of obtaining a sufficient volume of air with this system; the question which arose was the power that would be required for the purpose.) Mr. Gross, resuming, said that Dr. White had pointed out that with induced draught there was the same liability to those causes which induced leaky tube-ends, but he had come to the conclusion that the Serve tube itself was a preventive to leaky tubes; the extra stiffness afforded by the ribs in the tube giving a more secure joint at the tubeplate. Experience of locomotives on American railways supported this view, and they found that there was no leaky tubes with the Serve tube; whilst with plain tubes they were troubled with this cause when working under similar conditions. His own opinion was that the stiffness afforded by the ribs prevented the tubes from shaking loose.

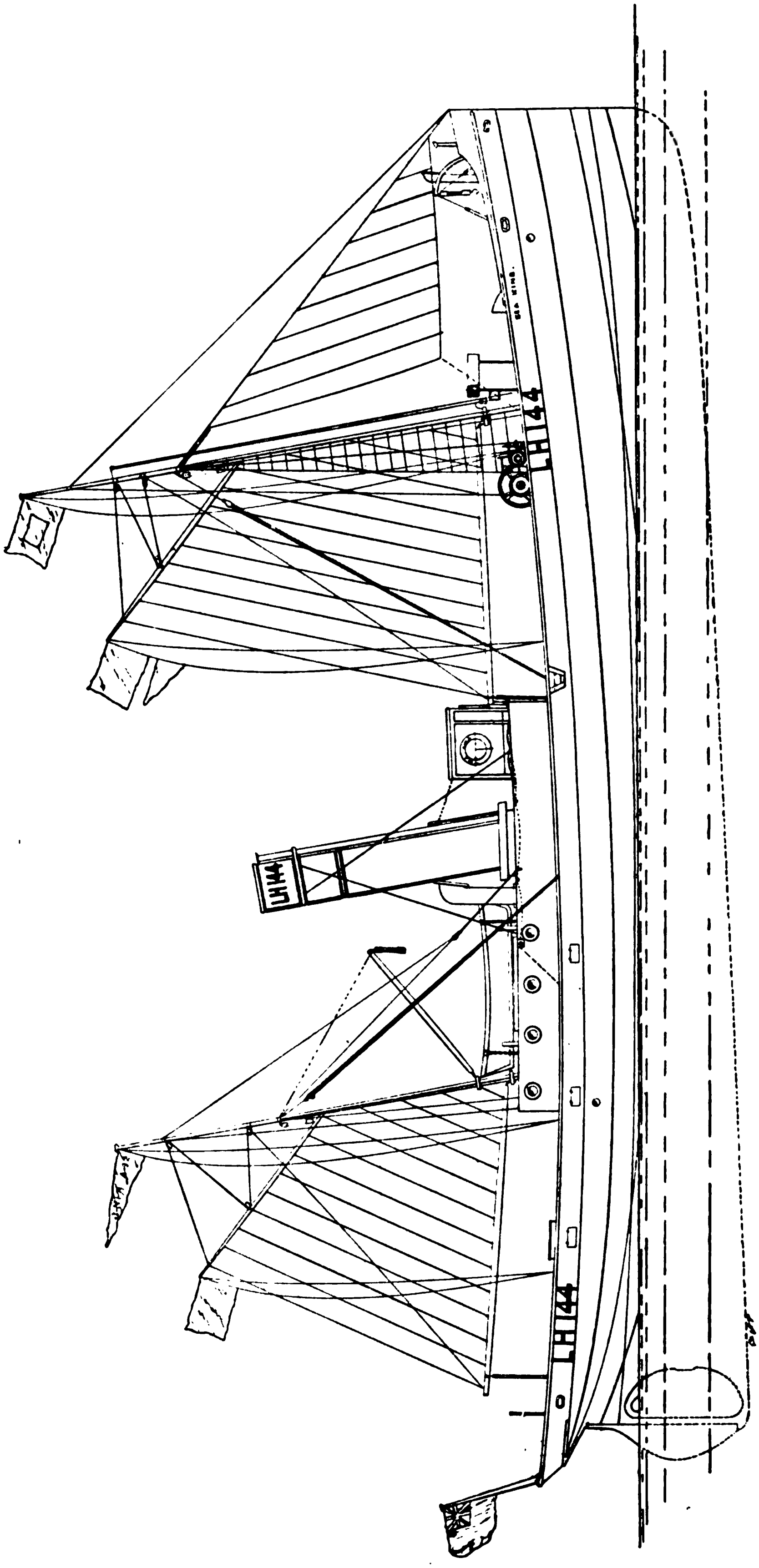
Mr. Ellis, in replying, said they could rely upon it that the experiments were correct, and they had been made in the presence of some of the members of that Institution, who could speak to their inaccuracy if they were not correct. The boilers were at the Atlas Works, and they would be pleased to see any member of the Institution who would come down and see these experiments carried on. The ship to which Mr. Gross had referred was the Inman vessel the *Berlin*. This vessel was 18 years old, and had never been very successful. It was decided by the engineers of the Inman Co. to try this system in the *Berlin*. When they came to deal with this vessel, which was hardly suitable for the work, gentlemen would easily see that they did not get such good results as they made with the experiments. But the vessel had been running since the 1st March, and she had certainly done very much better than she had ever done in her existence before. The Inman Co. were having two vessels built with this arrangement, and there were also other vessels being built with it. When these vessels got on to the water he had no doubt that they would then have very valuable information.

The President said he must offer his thanks, and the thanks of the Institution, to Mr. Ellis for his excellent paper. They all felt grateful to Mr. White, too, for inducing Mr. Ellis to put his modesty on one side and read to the Institution a paper so full of valuable information and good results obtained on so important a subject. Looking to the great improvements which were being made for commercial and naval purposes, in reducing the weight of boilers and the spaces which they occupied, any improvement which gave promise of securing these great and much desired advantages merited attention. Forced draught had been largely used in the Navy, and was now being more or less extensively used in the Mercantile Marine. The first application of a new method must naturally present difficulties. The use of forced draught had been attended with difficulties, and those difficulties had not been as yet entirely removed. It must, therefore, be a source of great satisfaction to all interested in the Mercantile Marine of this country to know that many ingenious minds were engaged in the solution of this problem. He could not but think that success in overcoming difficulties would be largely promoted when more men came to consider these matters rather from the outside, and taking some independent view. Mr. Ellis belonged to that class, and he was sure they were all glad, and the public should be grateful to Mr. Ellis, for the attention which he was giving to this great question of forced draught. He must also express his high opinion of the discussion to which the paper has given rise. The paper would form an important feature in, he hoped, a highly successful summer meeting of the Institute of Naval Architects.

STEEL SCREW TRAWLER "SEA KING."

PERHAPS there is no type of steamer which has made such a sudden rush on the market as the steam trawler. Ten or twelve years ago a steam trawler was looked upon as an innovation in a fishing port, nowadays, to use a popular phrase, no fish merchant should be without one. As they have risen in favour as a mercantile property, so likewise have the shipbuilders and engineers stepped in with alterations and improvements, until the class of vessels now being built are perhaps the strongest and swiftest for their size to be found anywhere. We have much pleasure, therefore, in placing before our readers plans and a short description of one of the most recent additions to the Firth of Forth trawling fleet, which fleet counts amongst its numbers some of the finest little vessels on the British coast.

The *Sea King*, which was launched during the month of May, from the shipbuilding yard of Messrs. Cumming & Ellis, Inverkeithing, is of the following dimensions:—Length, 112 ft.; breadth, 21 ft.; depth, 11 ft.; and is fitted with triple-expansion engines, which indicated on her official trial slightly over 520 H.P. As will be seen from the illustrations, she is ketch-rigged with a clear unbroken deck line right fore and aft, giving the greatest possible facility for handling the trawl nets, and also for passing the fish into the hold situated forward, and separated from the crew's quarters by a commodious ice-hold. A fresh water tank is also fitted forward to be used as a supplementary feed to the main boiler, as well as a ballast tank for trimming the vessel, whilst aft is fitted a large ballast tank, used for adjusting the trim of the vessel as the fish-hold is filled and emptied. A large Humber steam winch, having double cylinders 7 in. by 12 in., has been supplied by Messrs. Clarke, Chapman & Co., and this is place forward of the main hatch, where it can be utilised for the discharge of the cargo. All the other appliances about the deck are of the most modern and improved description. The accommodation for the crew is also on a more elaborate scale than obtains in ordinary trawlers. The after part of the vessel is fitted up for the accommodation of captain, officers, &c. The captain and engineer are berthed in separate staterooms, while the remainder of the after part is arranged as a saloon with two berths on either side. This saloon is handsomely fitted up in solid, polished wainscot oak, with panels of floral lincrusta tastefully tinted and picked out in suitable colours, the ceiling being painted in flat white, with tinted beam moulding. A handsome tiled fireplace is also fitted in the forepart, with



Steel Screw Trawler "Sea King." (See page 189.)

ornamental and large bevel-edged mirrors. A sofa of the best crimson American leather is fitted all round the saloon, and all the other furnishings are in keeping with the parts already detailed. Access to the saloon is obtained by a commodious entrance formed by the extension of the engine and boiler casings. Forward of the engines and boiler space is the fish-hold, suitably fitted up for the storage of fish; also a large ice-hold, for the purpose of preservation when required. In the fore part of the vessel are berthed the deck hands, this place being neatly fitted up with berths, seats, lockers, &c., and also with a large stove of the most modern description. The engine power, which we hope to be able to describe and illustrate in our next, has exceeded the guarantee, and has proved itself capable of propelling the vessel at a mean speed of 12·5 knots per hour, making her one of, if not the fastest trawler in the world. A description of the *Sea King* will be found amongst the launches in our June issue, and a good idea of the arrangements may be had from the sectional elevation and plan.

THE INSTITUTION OF NAVAL ARCHITECTS

THE summer meeting of the Institution of Naval Architects for the session of 1893, was this year held at the Town Hall, Cardiff, and commenced on Tuesday, 11th July. The very attractive programme that had been arranged and the special interest that was attached to the papers to be read, ensured a very large attendance of members, and further a strong local committee had arranged a series of excursions and entertainments which promised to add very considerably to the pleasure of the gathering. Lord Brassey, the President of the Institute, was unfortunately unable to be present at the inaugural proceedings, and his place was temporarily filled by Sir Nathanial Barnaby, the senior Vice-President present, who certainly proved a very genial and capable chairman. Among the best known of the members of the Institute present were Sir Edward Harland, M.P., Mr. W. H. White, C.B. (Director of Naval Construction), Mr. B. Martell (chief surveyor, Lloyd's Register), Mr. J. T. Milton (chief engineer, Lloyd's Register), Mr. John Scott, C.B. (Greenock), Mr. James Laing (Sunderland), Mr. Frank Marshall (Newcastle), Mr. H. H. West (Liverpool), Mr. Yarrow, Professor Biles (professor of naval architecture in Glasgow University), Sir James Ramsden (Barrow), Professor F. Elgar, LL.D., Mr. J. M'Farlane Gray, R. H. Barrett, R.N., W. W. Chilcott, R.N., Mr. W. Heck, G. Holmes (secretary), &c., while the company also included Professor Elliott (President of the Bristol Channel centre of the Institute of Marine Engineers), Captain Blackmore (Shipmasters' Society), Mr. James Adamson (honorary secretary, Institute of Marine Engineers), &c., &c. The occasion has also excited much interest even outside the United Kingdom, and the representatives of Continental countries who are attending the meeting include Mons. M. Barrier Fontaine, head of the French dockyards at Toulon; Captain Le Clerc, French Naval Attaché in London; and Captain Persico, Italian Naval Attaché in London. The British Navy is directly represented by Admiral Boys and Captain Fitzgerald, R.N., Captain-Superintendent of Pembroke Dockyard, and also, of course, Mr. W. H. White, already mentioned. The formal reception of the Institute by the Mayor (Councillor W. E. Vaughan, J.P.) took place in the Council Chamber. His worship was supported on the right by Mr. Llewellen Wood, president of the Cardiff Chamber of Commerce; and on the left by Mr. John Cory (Messrs. John Cory & Sons), president of the Cardiff Shipowners' Association. There were also present the following members of the reception committee:—Mr. C. A. Heywood, Count de Lucovich, Councillor J. Herbert Cory, Captain R. Pomeroy, Mr. E. P. Martin, Mr. W. Riley, Sir W. T. Lewis, Mr. J. B. Ferrier, Mr. E. Handcock, jun., Mr. John Moore, Alderman Daniel Lewis, Mr. J. L. Wheatley (town clerk), &c. The Council Chamber was completely filled.

Mr. C. A. Heywood, the Chairman of the Executive Committee of the Local Reception Committee introduced Sir Nathaniel Barnaby, the senior vice-president of the Institution, Mr. W. H. White, Mr. Martell, Sir James Ramsden, and other members of the Council and Institution; and regretted the temporary absence of Lord Brassey, the President of the Institute, who had been delayed in his journey to Cardiff by reason of the fact that his yacht had to put into Torbay under stress of weather, but had telegraphed that he was coming on by train as speedily as possible.

The Mayor of Cardiff then welcomed the members of the Institution to Cardiff, and hoped that the meeting would be attended with pleasure and advantage to the members and with benefit to the town. Mr. Llewellen Wood on behalf of the Chamber of Commerce, and Mr. John Cory for the Cardiff Shipowners' Association addressed a few words of cordial and kindly welcome, and Sir Nathaniel Barnaby responded in courteous terms of acknowledgment. The members having adjourned to the Nisi Prius Court, Sir Nathaniel Barnaby took the chair, and after a short opening speech, invited Mr. Benjamin Martell to read his paper on "Points of Interest in the Construction and Repairs of Oil Tank Steamers."

Mr. Martell commenced by referring to the great development that had taken place in this particular class of vessels, and in view of the serious damage that was so often occurring to many of these vessels and the great cost to underwriters attending their repairs, he raised the important question as to the general sufficiency of scantlings, and arrangements of details in their construction, and the points that should occupy special attention when the vessel came under repairs. The time that many of the vessels had been in existence enabled him to speak somewhat definitely on the point. Experience showed that the constant repairs necessary were due to deficient scantlings, faulty modes of arrangement of materials, bad workmanship, and last but not least, a want of proper care or knowledge in the management or the navigation of vessels carrying oil or water ballast in large quantities in bulk. He then clearly pointed out the differences of the strains that occur in ordinary cargo steamers and the petroleum tank steamers, and dealt very fully with the question as to the form of rivet to be used. Experience had shown that the plug-headed rivets used by some builders very considerably of late did not produce such satisfactory and efficient work as panheaded rivets with a swollen neck under the head. Where an unsatisfactory rivet exists, it should not be caulked, but be replaced by another rivet, sound workmanship being most absolutely essential to the production of a reliable structure. The spacing of bulkheads, length of tanks, and the means for strengthening the points of juncture between the various parts of the ship were then fully dealt with, and lastly the advantages and disadvantages of the arrangement of the engines amidships or astern were clearly set forth, the author coming to the conclusion that the question must be settled by shipowners, as to what port or ports the ship is to trade to. The Chairman, in thanking Mr. Martell for his valuable paper, invited discussion thereon.

Mr. Heck opened the discussion and expressed the opinion that the tanks should be made smaller. He thought that there was only one proper place for the machinery and that was astern, as it was most necessary to absolutely isolate the cargo from the machinery which could not be well done if the machinery is amidships. Mr. West advocated stronger rivetting and thought that the panheaded rivet had the advantage over the plugheaded rivet for the production of the most reliable work. He deprecated the filling of the fore and aft tanks and leaving the amidship tank empty in steamers going out in ballast, and suggested that it might be obviated by the provision of a flat in the tanks situated between the top and bottom. Mr. Swann complained of the treatment of oil ships and said that they were exposed to strains that an ordinary cargo ship would not be subjected to, special reference being made to docking and filling and emptying the tanks while at sea. Mr. Martell then replied, and expressed his agreement with Mr. West's views, and differed with Mr. Swann with regard to the caulking of rivets, because if a rivet wanted caulking it is unsound and should be replaced. Only within the last few days they had had an oil vessel put into Rotterdam which required 2,000 rivets renewing. He immediately investigated it and found plugheaded rivets had been used. Unless the greatest care was taken with plugheaded rivets the slightest action on the heads caused them to spring. The next paper was read by Professor Francis Elgar, LL.D., F.R.S.E., upon "Fast Ocean Steamships," in which he compares the structural details of the *Great Eastern* with the *Campania*. As we have treated this paper fully in an Editorial Note we do not think it necessary to give it in detail here.

Sir Edward Hartland, M.P., who opened the discussion, said he could not share with the author the admiration he felt in regard to the *Great Eastern*, he would have rather had a comparison made between the *Campania* and the *New York* or *Paris*, or the *Teutonic* and the *Majestic*, ships more nearly her size and age. A comparison merely with the *Great Eastern* was interesting, but not of great practical advantage. Professor Biles said he was very interested in the paper and considered that in his opinion the *Great Eastern* was one of the finest specimens of ships that the world had seen. He then dealt with the question of the effect of length upon the strength of the ship, and stated that they could safely infer that any increase of dimensions and consequent proportional increase of longitudinal strain need not involve as great an increase of weight as that of the cube of the dimensions. Mr. W. H. White said he was glad that Dr. Elgar had rescued from the old volumes of the Institution's Transactions the truth as to what Mr. Froude thought and said in relation to the effect of form on speed, and particularly in relation to the case of fineness of the ends upon the speed at sea. He thought the author would agree with him as to the utility of bilge keels, that as the size and inertia of ships increased, so the useful effects of bilge keels must diminish, and in some cases with which they had to deal they had found that no actual provision of bilge keels that could be fitted would produce any appreciable effect. Mr. Martell said he wanted to call attention to that part of Dr. Elgar's paper which suggested that in these large ships, the main structure should be continued up to the promenade deck, he thoroughly agreed in this as it would prevent excessive vibration. Dr. Elgar briefly replied. At this stage the meeting adjourned for the day. In the afternoon a luncheon of the most *récherche* character was given by the Mayor of Cardiff at the conclusion of which various toasts were heartily drank. Later in the afternoon the Members of the Institute visited the docks, and the Dowlais Works.

The summer dinner of the Institution of Naval Architects was held in the evening at the Park Hall, and was well attended by members and others to whom invitations had been extended. The chair was occupied by Sir Edward J. Reed, K.C.B., M.P., and among those present were the Mayor of Cardiff (Councillor Vaughan), Sir Edward Harland, Bart., M.P., Mr. Llewellen Wood (chairman of the Cardiff Chamber of Commerce), Count de Lucovitch, Sir N. Barnaby, K.C.B., Sir Morgan Morgan, Colonel Fisher, Mr. W. H. White, C.B., D.C.L., F.R.S., Mr. Councillor Johnston, Principal Viriamu Jones, Mr. E. R. Moxey, Mr. C. Heywood (chairman of the executive committee of the reception committee), Sir James Ramsden, Colonel Page, J.P., Mr. J. Gunn, J.P., Mr. B. Martell, Mr. J. Cory (president of the Cardiff Incorporated Shipowners' Association), Mr. J. B. Ferrier, Mr. F. K. Barnes, Professor Elliott, Councillor Cory, Messrs. John Duncan, James Laing, J. L. Wheatley (town clerk), John Scott, J. H. Stephens, George Fardo, David Gibson, George Sloggett, J. Macfarlane Gray, H. H. West, Alderman D. Lewis, Mr. Riley, Mr. E. Handcock, jun., Mr. C. E. Stallybrass, Captain Fitzgerald, Mr. W. Brock, Mr. R. Evans (manager Barry Railway Co.), Mr. J. D. Ellis, Professor J. H. Biles, Mr. J. Moore, Mr. P. Morel, Admiral Boys, Captain Persico (Naval Attaché to the Italian Government), Mr. M. V. Daymard, Mr. D. Dunlop, Mr. P. Turnbull, Captain Pomeroy, Messrs. A. F. Yarrow, James Adamson, E. Bregeon, W. Boyd, J. T. Milton, W. Anning, &c., &c.

At the conclusion of the banquet the usual loyal and other toasts were given.

On the second day the chair was occupied by the President of the Institution, the Right Hon. Lord Brassey, K.C.B., who had arrived at Cardiff in his yacht, the *Sunbeam*, at an early hour that morning. After an opening speech from the chairman, a paper entitled "Some Experiments on the Combination of Induced Draught and Hot Air Applied to Marine Boilers Fitted with 'Serve' Tubes and Retarders," which we print in full, with the discussion thereon, in our present issue.

The next paper was read by Mr. Andrew K. Hamilton, principal surveyor to Lloyd's Register at Cardiff, on "Wear and Tear in Ballast Tanks." This paper dealt with the nature and extent of repair of the various systems of construction of tanks rendered necessary by corrosion and other influences. In the discussion that followed the opinion was generally expressed that free and ample use of good anti-corrosion paint was the best mode of dealing with the liability of ballast tanks to suffer from corrosion.

The next paper was entitled "An Account of some Experiments on the Transmission of Heat through steel plates from heat gas on one side to water on the other." The author explained that the object of the experiments was to ascertain the rate at which heat was conducted through steel plates from gas at a high temperature at the one side to water at a lower temperature in process of being heated or evaporated at the other, as in a steam boiler—first, with varying differences of temperature at the two sides, and secondly, with varying thicknesses of plate. The plates experimented upon were of Siemens-Martin steel of the quality usually employed in the construction of steam boilers; and the results of the experiments were given in a series of tables appended to the paper. Alluding to these results, Mr. Blechynden said:—The broad general fact was evident that the units of heat transmitted through any of the plates per degree difference of temperature between the fire and the water were proportional to that difference, or, in other words, the heat transmitted was proportional to the square of the difference between the temperatures at the two sides of the plate. In concluding his paper the author said:—The results of these experiments certainly point to the conclusion that the thinner the plates forming part of the heating surface of a boiler the higher should be the boiler's efficiency, always provided that the plates are clean; but it will be evident that, if the plates be coated with a covering of scale, or some bad conductor, then the less must be the influence of the thickness on the efficiency, while with a thick coat of oil the influence might become practically unimportant. The fact that the heat transmitted is proportional to the square of the difference of the temperatures of the two sides of the plate shows the importance of high furnace temperatures if efficiency is aimed at, and emphasises the importance of rapid combustion, either by means of air supplied by fans or by height of funnel.

After a few observations by Mr. Yarrow,

The President said that speaking as an absolute layman on the subject, he thought he was not altogether wrong in recognising that there were certain conflicting considerations involved in this matter. It was evident that, while on the one hand the thinner the plate the more perfect the transmission of heat, on the other hand they might carry thinness of plates so far as to involve serious loss through want of durability in the boilers.

The conference then adjourned.

The members then proceeded to Caerphilly by train, where they were entertained to luncheon by the kindness of the Marquis of Bute, K.T. In the evening a conversazione was given to the members at the Park Hall, Cardiff, by the members of Bristol Channel Centre of the Institute of Marine Engineers. The spacious hall had been charmingly decorated for the occasion, and the function passed off with considerable *éclat*. An interesting exhibition of scientific and engineering instruments and appliances formed a prominent feature of the conversazione, these being displayed under the galleries. The list included the steam striker, invented by Mr. S. W. Allen, Cardiff; Mill's detaching hook for ship's boats; Mr. George Sloggett's "Log ship" sea anchor; the Lewis and Hunter's patent coaling cranes; Mr. Charles M'Connochie's metallic lubricating oil syphon; Cumming's shaft leveller; electric welding, by Messrs. Lloyd & Lloyd; Mr. Wm. Evans's improved screw propeller; Mr. J. S. Wyndham's electric ship's engine-room and steering telegraph and engine counter; an arrangement for the protection of propeller shafts from galvanic action in the neighbourhood of the brass sleeves, invented by Mr. Edward Jordan, of the Cardiff Junction Dry Dock; coal shipping crane invented by Mr. R. Laybourne, Newport; electrical fittings for ships; electrical apparatus for speaking between ships at sea without wires or cables, designed by Mr. S. F. Walker, Edison's phonograph, and a large number of models, drawings, &c.

The band of the 2nd Glamorgan Artillery Volunteers was in attendance (by permission of the officer commanding), under the bâton of Mr. Paul Drager, and performed a number of selections, the programme also including vocal selections by Madame Rees and Mr. Proud, organ performances by Mr. M. Gee, and a humorous sketch entitled "The Last of the Dragoons" (with original lime-light illustrations), by Mr. S. W. Allen. Later a dance took place, the programme comprising about half-a-dozen items. There was a very large attendance throughout the evening, and the function proved an undoubted success in every particular.

The third day's proceedings were commenced by the reading of a paper by Mr. J. T. Milton, the Chief Engineer Surveyor to

Lloyd's Register, on "Water-tube boilers for marine purposes." We intend to print this paper in full, with the discussion, in our next issue.

The following paper was taken as read, entitled "On the Theory of Thin Plating and its Applicability to Calculations of the Strength of Bulkhead Plating and similar Structures," by G. H. Bryan, Esq., M.A.

The members of the Institution at the conclusion of the meeting proceeded to Penarth and Barry, and visited the docks. They were entertained at luncheon by the Barry Railway Co., in a specially-erected pavilion for the occasion. In the evening they were entertained by Lord Windsor at the Windsor Gardens, Penarth. On Friday an excursion to Ilfracombe was provided at the invitation of the Presidents and Members of the Cardiff Incorporated Chamber of Commerce and the Cardiff Incorporated Shipowners' Association, a sumptuous lunch being provided at the Ilfracombe Hotel.

We cannot close this notice without bearing our personal testimony to the profuse hospitality and great kindness which has been extended to the members of the Institution of Naval Architects by the people of Cardiff, and to the very able manner in which the arrangements were made and carried out by Mr. Heywood, the Chairman, and the members of the Reception Committee.

THE INSTITUTION OF MECHANICAL ENGINEERS.

THE Summer Meeting of the Institution of Mechanical Engineers will this year be held at Middlesbrough, and will commence on Tuesday, August 1st.

The following papers are in the programme for reading and discussion:—"On recent developments in the Cleveland and Steel Industries," by Mr. Jeremiah Head, Past President, Chairman of the Reception Committee. "On the Middlesbrough Salt Industry," by Mr. Richard Grigg, of Middlesbrough; communicated through Mr. E. Windsor Richards, Vice-President. "On some Engineering Improvements in the River Tees," by Mr. George J. Clarke, of Stockton, Engineer to the Tees Conservancy Commission; communicated through Mr. Thomas Wrightson, M.P., Chairman of the Works Committee of the Tees Conservancy Commission. "Description of the Electric Rock-Drilling Machinery at the Carlin How Ironstone Mines in Cleveland," by Mr. A. L. Steavenson, of Durham; communicated through Sir Lowthian Bell, Bart., F.R.S., Past President. "On the Artificial Lighting of Workshops," by Benjamin A. Dobson, of Bolton; and "On the working of Steam Pumps on the Russian South-Western Railways," by Mr. Alexander Borodin, Engineer Director.

The outline programme, issued by the Institution, is as follows:—

On Tuesday, 1st August, 10 a.m., Reception of the President, Dr. William Anderson, F.R.S., and the Council and Members of the Institution, by the Mayor, Charles Lowthian Bell, Esq., and the Chairman, Jeremiah Head, Esq., and Members of the Reception Committee; Reading and discussion of papers; luncheon in the Town Hall, 2 p.m., Special free train from Middlesbrough Station, by invitation of the North-Eastern Railway Co. to visit blast furnaces and other works in the ironmasters' district west of Middlesbrough, returning by brakes from various works. The following works will be open to the visit of the members:—Messrs. Sir B. Samuelson & Co., Newport Blast Furnaces; Messrs. John Hill & Co., Newport Rolling Mills; Messrs. R. P. Dorman & Co, Sheet and Galvanising Works; Messrs. Dorman, Long & Co., Britannia and West Marsh Steel and Iron Works; Messrs. Gjers, Mills & Co., Ayresome Blast Furnaces; the North-Eastern Steel Co.'s Basic Bessemer Works; the Acklam Iron Co., Blast Furnaces; Edward Williams, Linthorpe Blast Furnaces; the Tees Side Iron and Engine Works Co., Blast Furnaces.

On Wednesday, 2nd August, 10 a.m., Reading and discussion of papers, Dr. William Anderson, F.R.S., President, in the chair; luncheon in the Town hall. 2.0 p.m., Special free train from Middlesbrough Station, by invitation of the North Eastern Railway Co., to visit blast furnace works, &c., east of Middlesbrough, at Cargo Fleet and at Eston. The following works will be open to the visit of the members. Messrs. Cochrane & Co.'s, Ormesby Blast Furnaces, Cargo Fleet; Messrs. Wilsons, Pease & Co.'s, Tees Blast Furnaces and Foundries, Cargo Fleet; the Cargo Fleet Iron Co.'s Blast Furnaces, including the Tees Scoriæ Brick Co.'s plant; the Normanby Iron Works Co.'s Blast Furnaces, Cargo Fleet; Messrs. Bolckow, Vaughan & Co.'s Blast Furnaces and Steel Works, Eston; the Clay Lane Iron Co.'s Blast Furnaces, Eston; 7.0 for 7.30. p.m. Institution Dinner in the Royal Exchange, Middlesbrough.

On Thursday, 3rd August, 9.0 a.m. Excursion to Port Clarence *via* Steam Ferry from Middlesbrough Ferry Landing; and to Thornaby; At Port Clarence visit Messrs. Bell Brothers' Blast Furnaces, and Brine Evaporating plant of the Salt Union; 11 a.m. Special free train, by invitation of the North-Eastern Railway Co., to visit the following works at Thornaby. Messrs. Appleton, French, Scrafton & Co.'s Cleveland Flour Mill; Messrs. Head, Wrightson & Co.'s Teesdale Iron Works; Mr. R. W. Crosthwaite, Union Foundry; Messrs W. Whitwell & Co.'s Thornaby Iron Works. 2 p.m. Luncheon in the Town Hall, Middlesbrough. 3.30 p.m. Special Free train to South Gare Breakwater and Saltburn. Visit gardens of Saltburn Estate by invitation of the owners, music and illuminations; Tea in the Assembly Hall, 9.30 p.m. Special free train returning from Saltburn to Redcar, Middlesbrough, Thornaby, and Darlington. 9.30 a.m. Alternative excursion (number limited to 40) by ordinary train (free, by invitation of the North-Eastern Railway Co.) from Middlesbrough to Saltburn, to visit thence one or other of the following Ironstone mines: North Skelton, Messrs. Bolckow, Vaughan & Co., Pneumatic Drills, Lumpsey; Messrs. Bell Brothers, Drilling by Hydraulic Turbine and Petroleum engine; Carlin How, Messrs. Bell Brothers, Electric Drills; Loftus, Messrs. Pease and Partners, Pneumatic Drills. Brakes from Saltburn Station to mines and back, 1.40 p.m. Ordinary trains (free) from Saltburn, arriving at Middlesbrough, 2.10 p.m., for luncheon, as above.

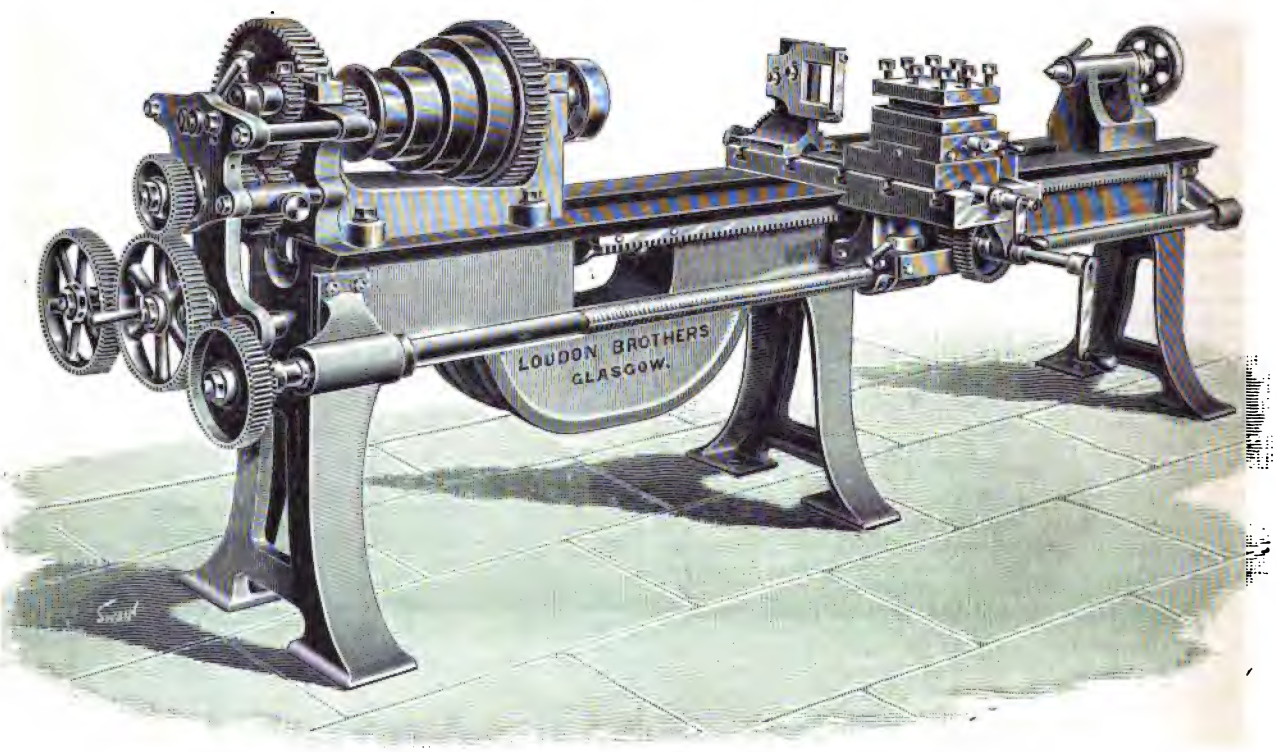
Friday, 4th August, excursion to Tees Conservancy Works and Hartlepool. 9. a.m. Special free steamer from the Corporation Wharf, Stockton; 10.0 a.m. special free steamer from the Middlesbrough Ferry Landing. (By invitation of the Tees Conservancy Commission to view the works along the course of the river.) Proceeding to Hartlepool, four miles from mouth of Tees and landing to visit the following works:—Messrs. T. Richardson & Sons, Marine Engine Works; Central Marine Engine Works; Messrs. William Gray & Co.'s shipyards West Hartlepool Steel and Iron Works; British Metal Expansion Works. Luncheon at Royal Hotel, West Hartlepool, 4.0 p.m. Return by steamer, arriving 5.30 at Middlesbrough, and 6.30 at Stockton.

SCREW CUTTING LATHE OF IMPROVED TYPE.

THE accompanying illustration shows a screw cutting lathe fitted with an improved arrangement of cutting gear and turret rest, the patent of Messrs. Robertson & Loudon, and made by Messrs. Loudon Brothers, Waterloo Street, Glasgow. The tool illustrated is a 9 in. centres, double geared, self-acting, sliding, and screw-cutting lathe, with a gap bed 12 ft. long, on which the above improved and patented system for gearing up the change wheels has been adopted. The swing-plate for carrying the gear between the leading screw and the driving pinion is pivoted on a stud, which carries the driving pinion instead of turning on the screw. There are also two wheels with 80 and 40 teeth respectively carried on a fixed stud on the swing-plate, the 80 teeth wheel being in constant gear with the driving pinion connected to the spindle of the lathe, the 40 teeth pinion on the same stud being utilized for compounding the wheels with the screw for fine pitches. By this arrangement any wheel from 20 to 120 teeth on the screw can be geared without any change of intermediates, and provision is made whereby with six change wheels, all Whitworth standard pitches of angular thread can be screwed for diameters from ¼ in. to 3 in., three different pitches being screwed by each of the six

change wheels without altering their position. Coarse pitches can also be screwed with equal facility. Provision is also made for giving the lathe a fine boring feed, suitable for opening a hole in solid metals, and is likewise capable of giving two different feeds without change of wheels.

The second feature of the tool illustrated is an improved turret rest for four tools, suitable for performing ordinary work between the centres of lathe as well as chuck work. For screw-cutting this is a great desideratum, as roughing out tools and finishing tools are fixed at the same time, and do not require to be moved except for sharpening. By the adoption of the above improved method a very great saving of time is effected in the working of the lathe and the altering from one pitch of screw to a finer or coarser one is very much simplified. From the name which is attached to the machine, we do not require to say anything as to workmanship, except that it is finished in the same perfect style as any of the other machines to which Messrs. Loudon Brothers have devoted their attention.



Screw-Cutting Lathe of Improved Type.

DEPARTURE OF H.M.S. "RESOLUTION" FROM THE TYNE.

THE new first class line-of-battleship *Resolution* being now complete, left the Tyne for Portsmouth on Thursday, 13th July. This vessel was launched on the 28th of May last year, so that the time taken to complete her is only a little over 13 months, which, considering the immense amount of work done since the launch; the drawbacks of various trade strikes, coupled with the fact that the sister vessel H.M.S *Revenge* has been fitting out simultaneously, is, we believe, unsurpassed by any previous performance of private firms, and is a proof of the enormous capabilities of her builders, The Palmer Shipbuilding and Iron Co., Limited.

The *Resolution* is one of the largest battleships afloat, comprising one of the eight built under the Naval Defence Act of 1889. An idea of the enormous size of the vessel may be gained when we state she is 40 ft. longer, 5 ft. broader, and 3,680 tons more displacement than the ill-fated *Victoria*.

The following particulars will doubtless be of interest, notwithstanding that the same appeared at the time the vessel was launched:—

The dimensions and particulars of the *Resolution* are as follows:—Length, 380 ft.; breadth. 75 ft.; draught mean, 27 ft. 6 in.; displacement, 14,150 tons; freeboard forward, 19 ft. 6 in.; freeboard aft, 18 ft.; I.H.P. forced draught, 13,000; I.H.P., natural draught, 9,000; speed forced draught, 17½ knots; speed natural draught, 16 knots; coals carried at the designed load draught, 900 tons.

The construction of the ship has been made exceptionally strong. She is built entirely of steel, the stem, sternpost rudder and shaft brackets being formed of cast steel.

The hull is divided into 220 water-tight compartments, and thereby reducing to the fullest extent the risk of danger to bottom plating from rocks and torpedoes, and rendering it practically unsinkable. There is a double bottom extending throughout the engine-room, boiler and main magazine spaces. The inner bottom is raised at the centre of the ship, and for ms the flat for the magazines which extend from the inner bottom to the lower deck. The engines and boilers are separated by longitudinal bulkheads extending the whole length of the magaz ne space. Longitudinal bulkheads at the sides extend throughout the machinery space and form coal bunkers and wing spaces. On the platform, debris and lower decks is placed the auxiliary machinery for the working of the ship, including steering engines, electric engines and hydraulic pumping engines, as well as fully equipped workshop and numerous storerooms. The officers and crew are accommodated on the belt and main decks. The officers' accommodation consists of handsomely

fitted cabins situated aft, the superior being located on the main deck. The Admiral's accommodation is at the extreme aft end of the main deck and communicates with a handsome stern walk. The upper deck extends from stem to stern without a break, and above it are the shelter decks, on which are the conning towers two in number, these are surmounted by flying bridges connected with each other by a fore and aft bridge. The boats, of which there are 21, including two 56-ft. torpedo boats, are stowed amidships. A strong steel derrick is fitted to the main mast for lifting them, and the foremast is also fitted with a derrick for working those of a lighter description.

The masts which are built of steel and fitted with military and signalling tops, and there are two funnels on the same athwartship's lines. The barbettes project through the upper deck a few feet, and inside are powerful hydraulic turning engines and all the gear for controlling the ponderous turntables and working the guns themselves.

A sloping protective deck of steel 2½ in. in thickness, extends under water from the bow for about 76 ft., and from the stern for a distance of about 72 ft., and between these two points there is a protective deck 3 in. in thickness, worked horizontally about 3 ft. above the water line; from the level of this deck there is a steel faced armoured belt 18 in. in thickness and 8 ft. 6 in. wide extending for a distance of 250 ft. of the midship part of the vessel, the thickness tapering at the ends to 14 in. Immediately above this belt there is also a light belt of armour 4 in. thick, extending for a distance of 144 ft. and terminating at the screen, bulkheads at each end, 3 in. thick, which extend from side of ship to sides of barbettes; behind this thin belt of armour, coal bunkers are arranged, whereby a large amount of additional protection is secured above the thick armour belt.

The four 5-in. guns on main deck are placed in casemates protected by armour plates 6 in. thick.

With a view of preventing water from finding its way below the protective deck, means are provided for closing the several openings by watertight covers, while in the case of those which must necessarily remain open cofferdams have been fitted with the same object.

ARMAMENT.—The main armament consists of four 67-ton breechloading guns of 13½ calibre with a training of 120 degrees on each side of the centre line, the auxiliary armament consists of the following, viz.:—Ten six-in. 100 pounder quick-firing guns, four in armoured casemates on the main deck, and six on the upper deck; sixteen 6-pr. quick-firing guns, four on upper deck and twelve on main deck; nine 3-pr. quick-firing guns, three in military tops and six for boats; two 9-pr. R.M.L. field guns; eight 45-in. five-barrelled guns, and seven torpedo tubes; four on the broadside, one at the stern, and two submerged. The total weight of the main armament is 1,410 tons, and the weight of the auxiliary armament is 500 tons.

The *Resolution* is lighted throughout with electricity by an installation of about 700 electric lamps, and is also equipped with four electric search lights of 25,000 candle power, each of which will be worked by a dynamo under protection. Means are so arranged that the ship when in action for fighting can do so from either of the two conning towers. The thickness of the forward conning tower is 14 in., and the after one, 13 in.

The vessel is fitted with twin-screw engines, each set having cylinders 40 in., 59 in., 88 in. by 51 in. stroke; there are eight single-ended boilers, each 15 ft. 6 in. diameter by 9 ft. 6 in. long, having in all 32 furnaces, 155 lbs. working pressure. There are no less than 69 auxiliary engines, *i.e.*, including steering engine, electric light engines and dynamos, air compressing engines, distilling engines, evaporator engines, boat-hoisting engines, workshop engines.

The 900 tons of coal carried at the designed load line will enable her to steam 5,000 knots at a 10-knot speed, but in case of necessity, she will be able to stow about 400 tons more, and so obtain a radius of action of over 7,000 knots.

When used as a flagship, the *Resolution* will have a complement of over 700 officers and men.

For want of space we are obliged to hold over the continuation of the article on the lubrication of marine engines, until our next number.

A computation has been made to show that to patent an invention throughout the world, costs £2,910, there being sixty-four Governments.

TRIALS OF H.M.S. "GRAFTON."

THE *Grafton* is the last completed of the nine first-class protected cruisers ordered to be built under the Naval Defence Act of 1889. She was designed by Mr. W. H. White, Director of Naval Construction, built by the Thames Iron Works and Shipbuilding Co., Blackwall, and engined by Messrs. Humphrys, Tennant, & Co., Deptford. She was, for the purpose of more fully testing her capabilities, taken around from Sheerness to Plymouth to enable her trials to be made in deeper water. The run round from Sheerness having enabled everything to be in readiness, the vessel, on the 24th June, began her official trials, which were attended by Mr. R. J. Butler, representing the Admiralty; Mr. R. Andrews, Engineering Department; Mr. J. Ryder, Steam Reserve, Chatham Dockyard; Mr. W. H. Gard, Constructive Department, Admiralty, and Mr. Soper, the contracting engineers; Captain Baynes, of the Steam Reserve, Chatham, being in command.

A continuous eight hours' full-power trial with natural draught to the boilers was first undergone, and gave the following mean results:—Steam was maintained at a boiler pressure of 154 lbs. per square inch, with ·41 in. of air pressure in the stokeholds, and, with a vacuum of 27 in., the engines attained a speed of 96 revolutions per minute, and developed a gross indicated power of 10,957 horses, giving the ship a speed by log of 19·5 knots, her draught at the time being 23 ft. forward and 24 ft. 3 in. aft. On Tuesday, June 27th, the weather being rather rough, the ship left Plymouth Sound at 8 a.m. for a four hours' forced draught full-power trial, of which the results were—that with 1·16 in. of air pressure in the stokeholds a good supply of steam was maintained at a boiler pressure of 148 lbs. per square inch, the mean vacuum was 26·7 in., the revolutions of the engines, which were remarkably uniform, reached a mean of 101·6 per minute, and the total I.H.P. developed by them was 13,484, the speed of the ship, taken at half-hour intervals by log, being 20·5 knots. The trials gave an excess in power developed by the engines over that contracted for of 957 I.H.P. for the natural draught, and 1,484 for the forced draught trials.

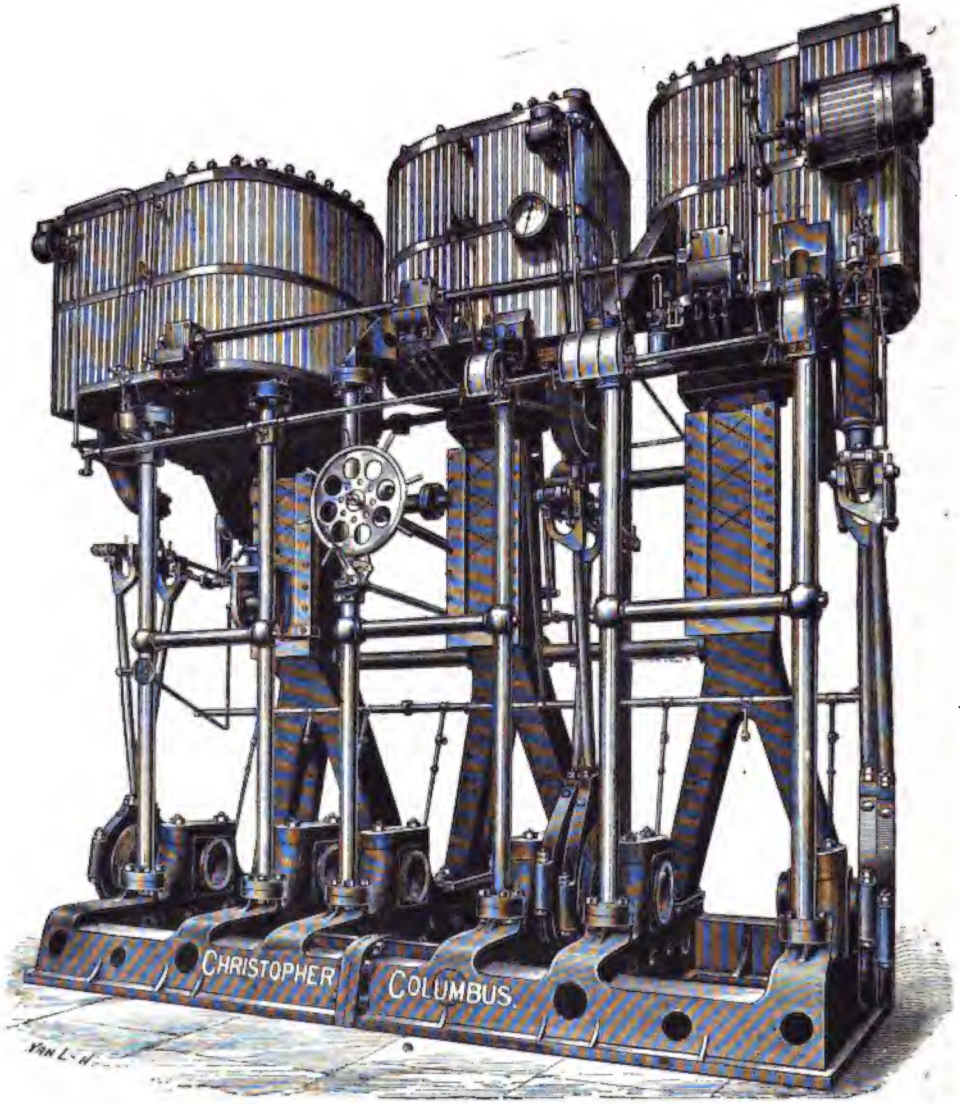
The *Grafton* is a cruiser of the *Edgar* class. She is 360 ft. long between perpendiculars, has a moulded breadth of 60 ft., and a mean load draught of 23 ft. 9 in., at which her displacement is about 7,400 tons. She is fitted with two three-bladed gun-metal screw propellers 16 ft. 9 in. diameter, each driven by a triple-expansion engine of the three-cylinder type, designed to develop a gross indicated power of 10,000 horses under natural draught, and 12,000 horses under forced draught. Both the trials of her machinery under the conditions imposed are considered to have been highly successful, and the results satisfactory. On the completion of the trials the vessel left Plymouth for Portsmouth, it being intended to carry out some special progressive trials on the passage.

THE PASSENGER WHALEBACK STEAMER, "CHRISTOPHER COLUMBUS."

THE Chicago Exhibition is the first, we believe, for which a steamship has been specially constructed to convey visitors to it—certainly it is the first at which such a notable vessel as the whaleback steamer, *Christopher Columbus*, has made its *début*. This vessel is the first of the type that has been built for passenger traffic, and the longest vessel to enter the port of Chicago, and is owned by the World's Fair Steamship Co., who have her engaged in making trips between the pier, specially constructed for the Exposition traffic, in front of the Auditorium, Chicago, and Jackson Park, a distance of about seven miles. The *Christopher Columbus* has been designed by Capt. Alexander Macdougal, the original inventor and patentee of the "Whaleback" system, and the manager of the American Steel Barge Co., West Superior, Wisconsin, the builders of the hull of the vessel. The engines and boilers were constructed by Messrs.

Samuel, Hodge & Co., of Detroit, Michigan, and it is noteworthy that the engines, which are of the triple-expansion type, are the largest marine engines as yet constructed by any American Lake firm.

The *Christopher Columbus* is built of steel and is of the following dimensions:—Length, over all, 362 ft.; breadth, extreme, 42 ft.; depth of hold, 24 ft. The construction of the hull proper is practically identical with the cargo carrying "Whaleback" vessels, although the water lines both forward and aft are much finer than in these craft. The bow with its round-ended waterlines, continued a considerable distance aft, has a snout-like appearance, and along with the rounded gunwale, are two leading features in the design. Above the curved gunwale and steel deck forming the upper portion of the main structure, rise seven turrets, elliptical in shape, which are the main support for the two decks erected overhead, and which are devoted to spacious and luxurious passenger accommodation. The forward turret is 19 ft. in length, 13 ft. in width, and contains the windlass. The second and third turrets are 26 ft. in length, 18 ft. in width, and inside of them companion-ways are fitted to the saloon deck above, and to the 'tween deck below the weather deck. The fourth turret 27 ft. in length, 18 ft. in width, contains the funnel, air-fans and ash-hoists, also the entrance to the boiler-room. The fifth turret, which is of the same size is, in reality, the engine-room casing, and the sixth and seventh turrets are fitted up with companion-ways similar to the second and third.



There are four gangways on each side by which passengers can enter and leave the ship from the 'tween deck, upon which the crew space is fitted up forward with specially good accommodation. About amidships is a splendidly fitted up temperance bar, but the principal accommodation for passengers is on the two upper decks. The vessel has a double bottom 3 ft. 6 in. deep, extending all fore and aft, having a water ballast capacity of 730 tons. The tanks are constructed on the Macintyre principle, having nine longitudinal girders 3 ft. apart. There are nine watertight bulkheads, and in addition from the bow there extends a longitudinal central bulkhead for 42 ft.

The saloon deck, in addition to being supported by the turrets already described, is connected to ventilator tubes on each side of the vessel 9 in. in diameter, placed 12 ft. apart. The grand saloon is 225 ft. long and 30 ft. wide, and is undoubtedly fitted up most completely and artistically, as is also the ladies' cabin —both being heated by steam and lighted by electricity, as is the vessel throughout. Outside the saloon on both sides of it there is a promenade deck 4 ft. wide, and forward and aft of the saloon at each end a clear space of 32 ft.

Above the saloon deck is the promenade deck proper, which is 257 ft. in length, having a central skylight over the saloon, and smaller dome skylights over the fore and aft companionways. On this deck are the captain's cabin, the wheel-house, and the officers' quarters. All the deck seats are constructed so as to form life rafts in the case of an emergency, and life belts are at hand throughout the vessel, so together with the sixteen lifeboats provided there should be little fear of any grievous disaster, despite the fact that the vessel has accommodation for 4,000 passengers. It is noteworthy that the iron and steel used in the construction of the vessel was manufactured by the shipbuilders, and that within eight months the raw material, ore, &c., was converted into the launched vessel.

The engines which we illustrate of the *Christopher Columbus* are thus far the largest marine engines built on the American chain of lakes. They are of the inverted vertical triple-expansion type, with cylinders of the following dimensions: High pressure cylinders, 26 in. diameter; intermediate, 42 in.; low, 70 in., having a piston stroke of 42 in. The high pressure cylinder is fitted with a piston valve, and the low and intermediate with double ported slide valves, the port openings being ample for a piston speed of 770 ft. per minute. None of the cylinders are jacketed, but the high pressure is fitted with a hard cast iron liner. All the valves are worked from the ordinary, independently adjustable link motion, all the joints having liberal wearing surfaces, and the position of the links is controlled by a combined steam and hydraulic reversing gear, and also a screw hand and worm reversing gear.

The bedplate is of the box type fitted with six journals each 16 in. long. The crankshaft is of the built-up type, being 13 in. in diameter, and made in three interchangeable parts, with steel crank-pins 12½ in. diameter, 14 in. long. Each crank is provided with a counter-balance of sufficient weight to balance the pin and its webs. The crank-pin boxes and the main journals are made of brass, fitted with Babbitt strips.

The framing consists of three cast iron forked columns on the back of the engine, and six finished wrought iron columns on the front, all well braced together. The cylinders are independently fastened on columns, but tied together with fore and aft steel rods, leaving them free to expand. The cross heads are constructed of cast steel and with large brass wearing parts.

The pistons are of the conical pattern, made of cast steel and fitted with through piston rods. Each cylinder is provided with independent direct steam valves, and all hand as well as other gear, is connected to a central position in front of the engine. The lubricating arrangement is very complete. The cylinder covering consists of narrow white wood staves alternated with plated moulding on the sides; and in addition to this the tops of the cylinders are covered with finished closed grating, and polished conical heads, the latter carrying the casing for the upper end of piston rods. A combined steam and hand power turning engine is provided. The air feed and bilge, and other pumps are fitted independent of the marine engines. The air pump is of the Knowles's vertical type, and has two 38 in. buckets worked direct from a pair of compound steam cylinders respectively 15 in. and 30 in. in diameter with a stroke of 21 in.

The two feed pumps, bilge pump and cold water pump for condensers are combined in one machine with one steam cylinder. The exhaust steam from both these pumps passes through a feed water heater, where most of its latent heat is thus given to the feed water. The propeller is 13 ft. 6 in. in diameter, fitted with adjustable blades. These engines indicate 3,000 H.P., with 170 lbs. initial pressure of steam when cutting off at 8-10ths of the stroke.

WALTERS' PATENT MARINE GLUE.

MR. THOMAS BEYNON, of Dean Street, Newcastle, has been appointed agent in the Tyne and Wear district, including also Blyth and the Hartlepools, for the sale of Walters' Patent White Marine Glue, and from his extensive connection among shipowners there is little doubt that the proprietors of the speciality have acted wisely in entrusting to this gentleman the care of their interests in the North-Eastern ports. The glue is used for paying deck seams, coating tank tops and bilges, cementing floors, stopping propeller bosses, &c., and though it is applied in the same way as pitch, it is guaranteed to last twice as long. It is indeed much more economical than either pitch or putty, besides being more cleanly, and in every sense more effective. The proprietors have received numbers of testimonials from shipowners, captains of vessels, Admiralty officials, &c., testifying to the qualities of the glue for the purposes previously indicated, and the present users of the speciality may be counted among the most important ship-owning firms in the country. The Admiralty have adopted this glue for paying the bridges and decks of several vessels, among which may be mentioned H.M.S. *Centurion*. It may be added that as recently as July 10th the superintendent of the Harrison line of steamers, Liverpool, sent to the proprietors of this speciality a communication testifying in the most emphatic terms to its superiority as a medium for paying deck seams, &c. The merits of the article on the whole appear to be very exceptional, and in Mr. Beynon's hands there is little doubt that it will soon command a good sale on the North-East coast.

JOHN WHITE'S HALF-YEARLY SHIPPING REVIEW.

AFTER three years of severe depression there are at last signs of improved prospects for shipowners and shipbuilders. At the commencement of the year about 600,000 tons of steamers were laid up in our home ports, and a large number of sailing vessels idle on the West Coast of America and in India. This tonnage is now practically all at work; freights have not only improved, but are considered by many experienced owners likely to further advance. The principal causes of this improvement are probably to be found in the following facts: The tonnage removed from the register during the past half-year very nearly approximates the tonnage added; an exceptionally large importation of breadstuffs and fodder will be needed through the severe drought here and on the Continent, and fortunately harvests in America, Canada, India and Russia promise large crops; the arrangements that have been made in connection with Argentine finances have created greater confidence, and important

imports are being made into that country whilst the rich resources of the country are being proved by the large exports of cereals; all branches of commerce have for three years following the financial crisis of 1890 been restricted to the narrowest possible limits, and with more confidence, which undoubtedly exists, a reaction in trade may be expected. It is to be hoped that orders for new vessels will be kept within moderate bounds, so that the improvement in freights is not dissipated by too rapid increase of tonnage.

The total of steamers and sailing vessels in course of construction at the end of the half year was 300,000 tons less than twelve months previously. The tonnage preparing at the end of the March quarter was only half the quantity of the same period last year, but the total preparing at the end of last month will doubtless show a considerable increase on the previous quarter, there having recently been some important orders placed.

Material is extremely cheap, although prices have advanced about 7½ per cent. during the past few weeks. Wages in all departments of shipbuilding and engineering have been reduced during the past half year. Coals are considerably cheaper.

The prices at which contracts have lately been placed are unprecedented, but having been taken by responsible firms who are not likely to accept less than cost, proves the economies that have been made in shipbuilding, to enable steamers to be produced at such figures. The prices excepted for steamers of 5,000 tons have not exceeded what would have been the cost of a vessel half the size ten years since, or what would have been paid four years since for a vessel of 3,000 tons.

There have been two or three minor strikes amongst joiners and other workmen during the half year in addition to the serious Hull Dock strike, of about six weeks' duration, owing to the men taking up a most untenable position, in which they were completely defeated to their serious loss and the great regret of shipowners at the occurrence.

The Australian Bank failures have necessarily affected the large quantity of shipping trading between England and the Colonies, as well as on the Australian coast. The lines in this trade are undoubtedly passing through a severe trial in keeping their vessels running to supply the limited requirements of merchants for tonnage. It is to be hoped that as the crisis was brought about through land speculation and not unsoundness of trade, the vast resources of the Australian Colonies will soon evidence themselves in an improvement in trade.

The vexed silver question has a prejudicial effect on shipping, as it must necessarily restrict many merchants exporting to ports where there is so much uncertainty as to the result of Exchange operations, probably the move that has lately taken place, although far from settling will be the means of bringing about a settlement of this question.

Prices of second-hand steamers of the old type have continued to decline, and do not appear likely to improve until we have a very important advance in the prices of new vessels. Sailing ships are not much in demand, and have declined very considerably in value, as might have been expected from the rapid increase in these vessels for the three years prior to last year.

Freights during the early part of this year ruled very low, with little variation until the close of the half-year, when an improvement took place in several trades.

Eastern rates homewards have continued low. From the Philippines 30s. U.K., 32s. 6d. U.S., and 35s. Canada. From the Rice Ports, 27s. 6d. Calcutta has been a dull market at from 17s. 6d. to 22s. 6d., jute. From Bombay as low as 18s. was accepted in February and March, but during May there was no active demand for prompt tonnage, when 20s. to 21s. was paid, and at these figures a considerable amount of business was done. Rates are now down to 17s. 6d., with little demand, but all in the Eastern markets there is a waiting tendency for the development of the silver question.

From the Black Sea there has been a large amount of business but at low prices. At the beginning of the year 7s. 6d., was accepted from Sulina, and the same from Odessa. On the opening of the Danube these rates advanced to 9s. from Sulina, and 11s. Danube. During May prompt tonnage commanded as high as 16s. from the Danube, but these rates have since declined to 13s.

The Baltic has been a very poor market, rates ruling about 1s. to 1s. 1½d. wheat from St. Petersburg to London, 20s. deals Gefle to London, 2s. to 2s. 3d. oats Archangel to London.

From the Mediterranean a large business has been done for ore, rates have remained throughout the half-year at 7s. to 8s., according to port of loading; Mediterranean to the States 7s. to 9s., according to port.

From America homewards there was little demand until within the last month. At the beginning of the year, from the Northern ports 2s. 3d. c.f.o. was freely accepted, and this rate declined to 2s., remaining low until towards the end of June, when there was a demand for prompt boats, 3s. and in one instance 3s. 6d. was paid. The reports from the States and Canada are promising of large crops, and it would not be surprising to see autumn freights advance beyond present quotations. The export of phosphate cargoes from America has largely increased during the past half-year, and appears likely to become an important source of employment for steamers.

From the River Plate the import of cereals increase each year. providing employment for a large amount of tonnage. 20s. grain was current for the first three months of this year, and advanced to 24s. in May, but the rate has since declined to 17s.

A new trade for steamers has arisen during the half-year in the import of hay from the River Plate, Canada and the United States, for which several boats have been chartered. From the Plate about 40s. to 45s., and from Montreal 50s. to 60s. per ton of 20 cwt. have been paid.

Outward rates in all directions have ruled low throughout the past six months.

It is satisfactory to be able to report that the prospects for the shipping industry are certainly much more promising at the close of the half-year than they were at the commencement.

GEDDES'S PROTECTOR FIRE DOORS.

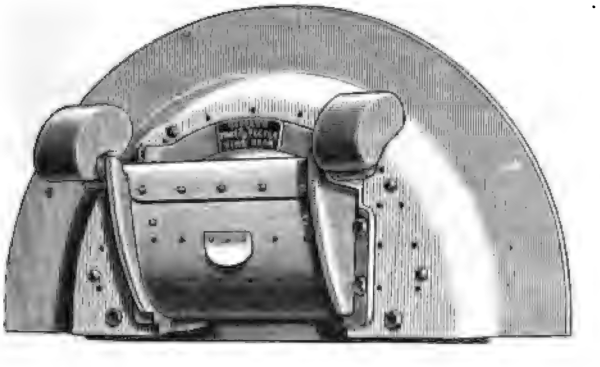
We illustrate in this page an improved Fire Door for marine boilers now being introduced by Mr. Geddes, of Drury Buildings, Liverpool, which overcomes practical difficulties which are experienced by all engineers. The tendency of firemen to bring the fires too close to the doors is well known, and the result is the frequent renewal of baffle plates and the possible leakage of the rivets in the furnace front. As will be seen in the illustrations the dead plate in the improved door is recessed beyond the line of baffles, the lower part of the door being curved inward to fill the recess. This arrangement

not only protects the baffle plates but the firing space is much larger and affords increased facilities for good stoking. The doors are formed of stamped steel plate with patent rolled steel spindles of special section; the balance weights are of cast iron, riveted to the rolled steel spindles; the frame is of cast iron, and the whole is of the strongest construction, and is practically indestructible.

The furnace front plates are of steel, stamped under hydraulic pressure into a form which gives great rigidity and prevents buckling, at the same time pro-

viding a recess for the convenient arrangement of the cast-iron baffle plates.

The improvement certainly has the merit of being



thoroughly practical, and will no doubt meet with the approval of all marine engineers.

THE FLEETS OF THE MAIL LINES.

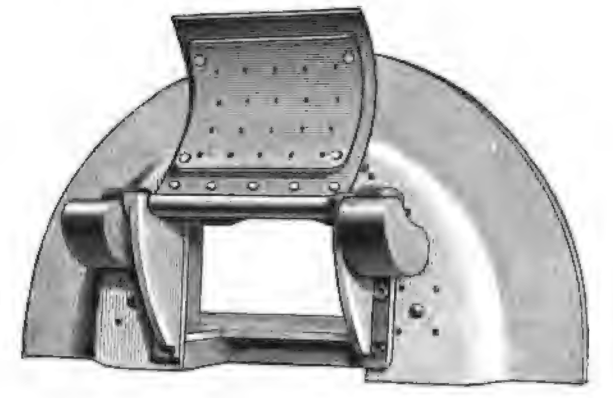
THAT exceedingly energetic company, the Great Eastern Railway, is endeavouring to make its route to the continent one of the most expeditious and comfortable of the many that now bid for the constantly increasing traffic. Their route to the continent *via* Harwich has long been noted for the excellent vessels which are run in the service, and the public has not been slow to recognise the fact. In the dozen years the number of passengers annually using the route has increased nearly five-fold. This has only spurred the Great Eastern and its Dutch allies to further exertions. They discovered that with steamers of their old type they might save two hours on the journey to Rotterdam by landing their passengers at the Hook of Holland and instead of carrying them up the river by steamer. The Dutch built a landing place and connected the hitherto desolate spot with their railway system, whilst Messrs. Earles, of Hull, constructed the twin-screw liner *Chelmsford*, and at the beginning of June the new route was an accomplished fact. The *Chelmsford* is a vessel of 300 ft. in length, and 5,000 I.H.P., doing her 18 knots; already she has proved herself so successful that her owners have felt themselves justified in ordering two similar vessels from the same yard to aid her in the service. They are to be somewhat larger and faster but similar in design, and of course fitted with twin screws. The saving in time to travellers to Holland and Northern Europe generally will, with these vessels, be nearer four hours than two over the old route with its old boats.

The North German Lloyd's *Kaiser Wilhelm II.*—their largest vessel—has recently been engaged in the Mediterranean service, instead of that to Australia for which she was designed. She was to have left Genoa for New York on the 5th of June, but two days previously she met with a strange misfortune. The circulating pumps were being repaired, and in the course of the work a valve gave way, with the result that her engine and boiler-rooms filled and she sank forthwith. She was, of course, refloated without difficulty, but the cargo on board was spoiled, and the voyage had to be given up. After temporary repairs she left for Bremen, where she arrived on the 20th, and after being put thoroughly in order took the mail, sailing from Southampton on the 9th July; considering all the circumstances and the trivial cause of the accident, the owners will probably find it a very costly experience. The Bibby line running from Liverpool and London to Rangoon, with a fleet of four modern steamers, has ordered a fifth from the builders who have served them hitherto so well, Messrs. Harland & Wolff, of Belfast. The new boat is to be called the *Staffordshire*, and, like her two most recent sisters, is to be fitted with twin screws. This, it may be remembered, is the line in respect of which the Government recently issued a notice that public servants travelling by its vessels to the East by it should in case of delay through accident be in the same position as though they were travelling by P. & O. steamers. Messrs. Harland & Wolff have just launched a new White Star boat—the *Gothic*. She is intended for the New Zealand trade, in which the line already has three vessels engaged under charter to the Shaw, Savill & Albion Co. Though the *Ophir* is at work in the Australian trade, the *Gothic* will be remarkable as the first double screw in the New Zealand service, and will also be the largest vessel trading to the antipodes. A Board of Trade inquiry into the circumstances under which this line's cargo steamer *Naronic* came to be missing on her seventh outward voyage, was held at Liverpool on the 3rd and 4th July. After taking the evidence the inquiry closed, and the inspector will make his report to the Board direct. We cannot therefore comment on the case at present, but it is perhaps allowable to remark that after reading the evidence one could not help exclaiming "This is indeed a mystery of the sea."

In last month's issue we noted the sale of the Guion liner *Wisconsin*. On the 13th July her sister the *Wyoming* was offered for sale by auction at Liverpool. The best price offered was £3,700, and she was withdrawn. The most material difference between the two sisters is that whilst the *Wisconsin* was recently fitted at considerable expense to carry 2,500 quarters of beef in a refrigerating chamber worked on Kilbourn's ammonia system, the *Wyoming* has a similar installation on the Bell-Coleman principle.

It is said, but with what truth we know not, that the stresses set up by the vibrations of the *Campania's* engines have had an effect beyond what was anticipated by her designers, and that the *Lucania* will have her midship plating increased to withstand it. The appearance of the two sisters will thus be somewhat dissimilar.

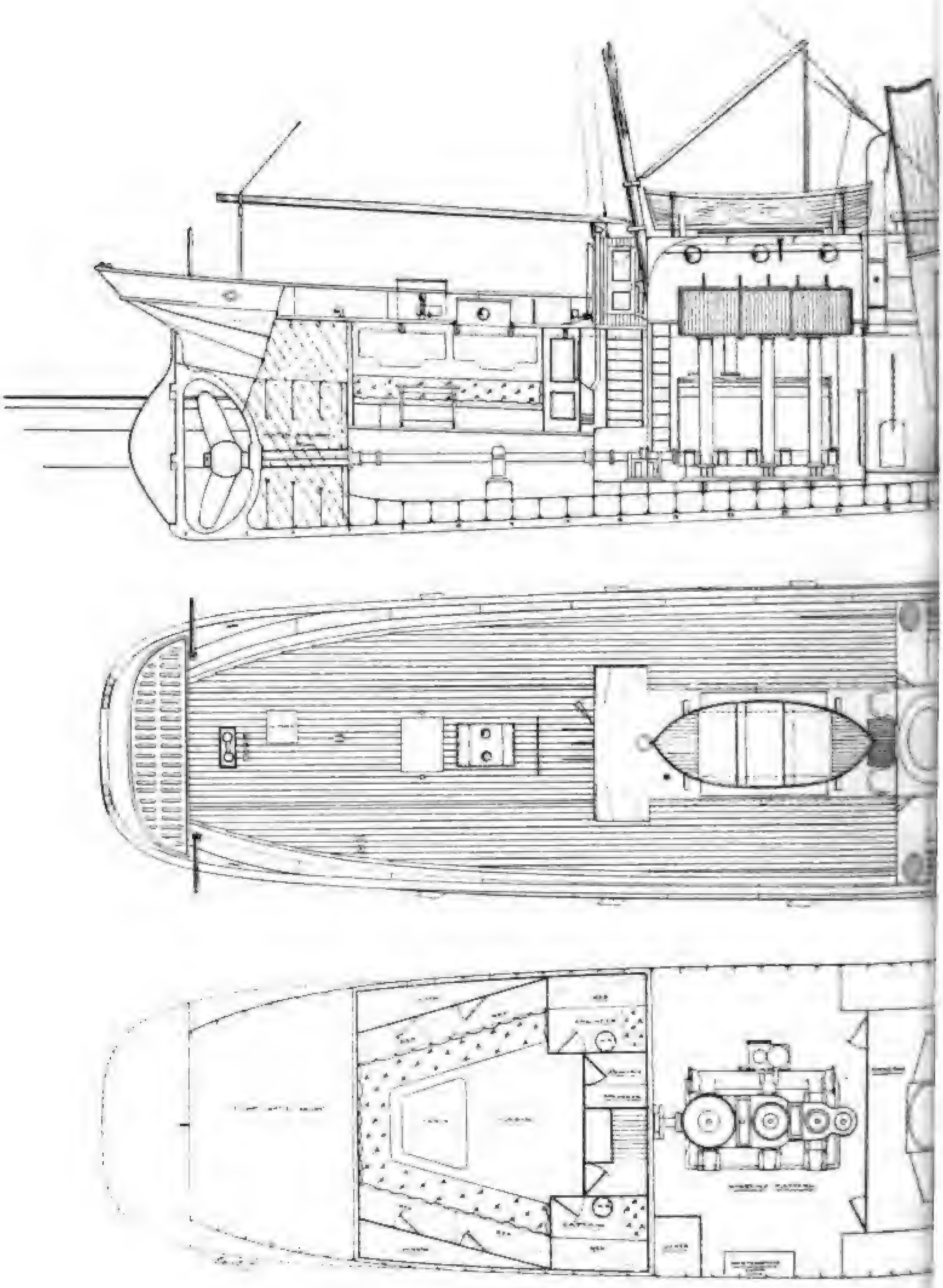
The loss of the s.s. *Khiva*, which left Bombay with some 900 pilgrims on board bound for Jeddah, may be within the recollection of some of our readers. The vessel took fire when 151 miles off the Arabian coast on the 17th April, and Captain Schumaker ran her ashore at Ras Merbat to save life. An inquiry was subsequently held into the disaster at Bombay, where the vessel was registered, and all interest in the case might well have been considered at an end. But a fortnight after the English papers had told us the result of the enquiry comes a telegram from San Francisco giving the accident as a piece of news which had just come in by the China mail. Even then they could not tell the tale correctly, for they called her a P. & O. steamer. She undoubtedly was so once but P. & O. have parted with her some



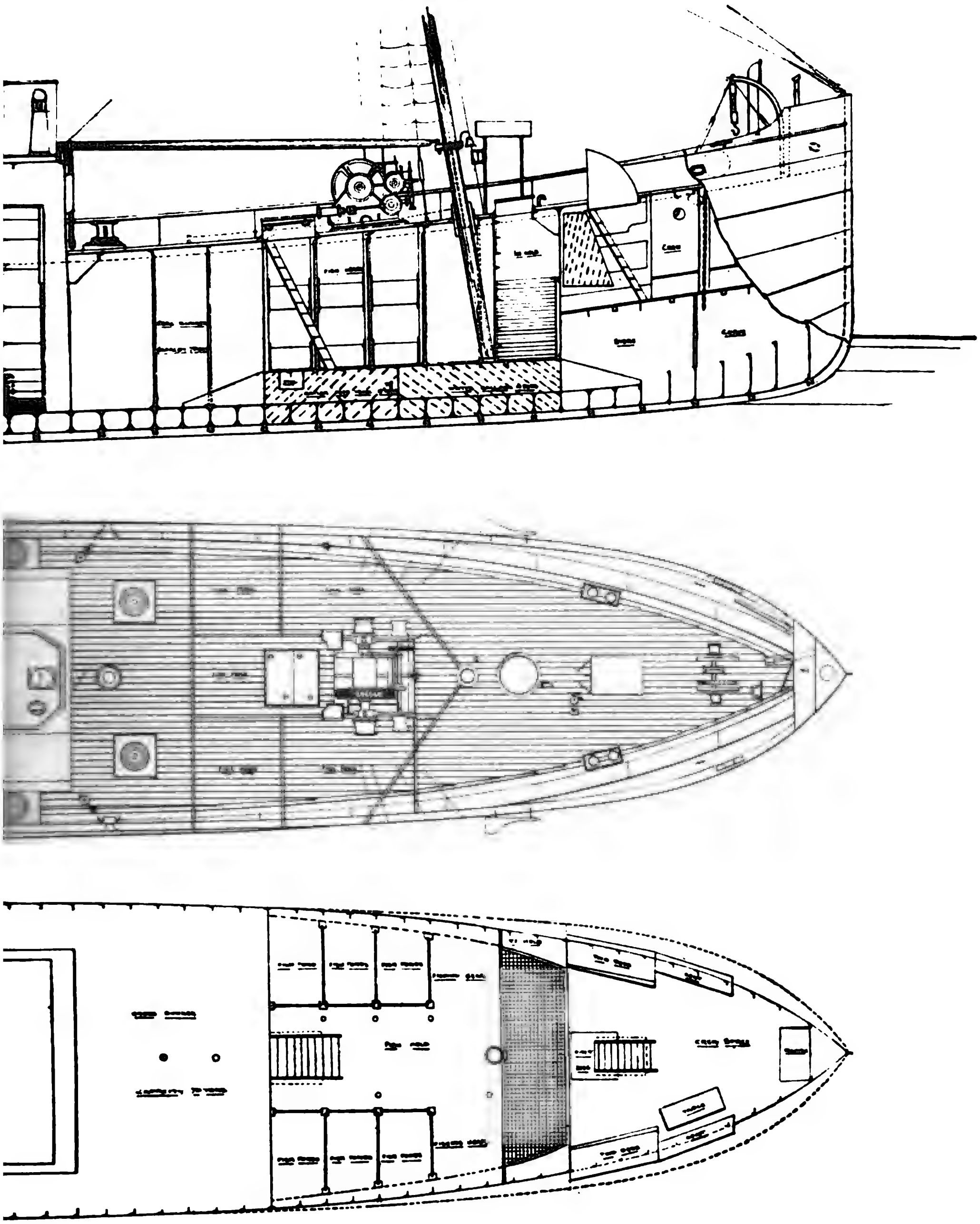
three years, and so they lose neither in money or prestige by this calamity which, like most fires at sea, seems to have arisen from causes quite beyond the control of those in charge of the vessel or even of her owners.

The end of July, when the short Atlantic course is taken, is the time when the "record season" on the Atlantic opens. The Liverpool lines have prepared for it by giving each of their boats in turn an extra week at home for docking. The American Line has achieved the same end in regard to their *Paris*, by sending her to Tilbury from Southampton, after discharging her eastward cargo, scraping and painting her there and bringing her back to Southampton, loading her again and dispatching her to the westward all within a week. After this they hope to get the *Paris* and *New York* round in three weeks, giving them only three days in port at each end of the trip.

The month of July saw the launch of the *Southwark*, a new



STEEL SCREW TRAWLER "SEA KING," BUILT BY



Umming & Ellis, Inverkeithing. (*See page* 189.)

twin-screw cargo boat, built by Messrs. Denny, of Dumbarton, for the International Steam Navigation Company, an organisation more or less closely connected with that which owns the American Line. She is the first of the fleet which is building. Quadruple expansion engines and boilers with a working pressure of 200 lbs. ensure economy of working, whilst safety at sea is aimed at by a close attention to the requirements of the Bulkhead Committee. She is said to be the largest cargo boat afloat, but as she is fitted with accommodation for 80 saloon and 1,000 steerage passengers she aims at being something more than the big cattle boats owned by other first-class lines.

By the way, there is one record to chronicle this month. That of the *Scot*, which on her last homeward trip lowered her own record by the substantial amount of eleven hours. There was another record claimed for the Dominion liner *Labrador* on the Canadian Atlantic route. This, it is said, is "only a record for the Dominion line." The person who rushes into print to say so does not, however, take the trouble to tell us what other vessel ever did better, and nowadays assertions as to record must be backed up by demonstrable proofs, and by something more than mere hearsay. Next month I hope to have something to say about the Canadian record in this column.

The lesson of the hard times through which shipowners have passed has not been altogether lost, and the old ships of the mail lines which in these days cannot any longer be worked at a profit, are rapidly being discarded. The month of July has seen the sale of the West India and Pacific Co'.s *Australian*—one of the last of their old fashioned boats. She was a vessel of nearly 2,500 tons, built at West Hartlepool in 1867, and she has gone to Dutch owners.

The ill-fated *Eider*, as our readers will remember, was taken from Southampton to the Thames in the spring by tugs, and it was rumoured that she was to be refitted and then employed in taking visitors to the Chicago exhibition. Circumstances have however altered. The existing facilities are found quite capable of dealing with the flow of passengers to the States, and it would seem that the last stages of her career are being reached, for a sale of cabin fittings on board of her is announced for the 31st July, and we hope to again refer to it in our next issue.

The fracture of the *Ionic's* shaft in the South Atlantic, when after drifting 47 miles in 66 hours she was picked up by the *Hawarden Castle*, homeward bound, and towed into Capetown, has resulted in a salvage action wherein the salvors, who estimated the value of their services at a sum of no less than £25,000 obtained an award of £7,000. This seems a large amount for a fine weather towage, but the work took a mail steamer back 857 miles and delayed her mails no less than eight days, besides effecting salvage of property of a value of £140,000 and bringing into port upwards of 200 persons.

The Judge paid a well-deserved compliment to Captain Kidley on the high state of discipline maintained by him on board the *Ionic*, as evidenced by the facts brought out at the trial.

THE WALLSEND PONTOON CO., LIMITED, CARDIFF.

AN interesting piece of work has recently been performed on this pontoon, which ought to be specially noticed by shipowners and underwriters.

The s.s. *Borghese*, owned by Messrs. Raeburn & Verel, of Glasgow, and of dimensions 289·6 ft. by 35·4 ft. by 25·9 ft., carrying a full cargo of 2,400 tons, whilst coming up the Bristol Channel on Thursday, June 8th, collided with the s.s. *L. E. Charlewood*, and the latter sunk in a few minutes. The bows of the *Borghese* were completly smashed in, but the fore collision bulkhead remaining intact, the vessel was kept afloat, and she was able to reach Cardiff. In her then condition she was drawing 20 ft. 6 in. of water fore and aft, a draught that prevented her entering any dry dock in that port. The Wallsend Pontoon Co., Limited, offered to endeavour to place her on their Pontoon without discharging any cargo, and raise her to such a position that the whole extent and nature of the damage might at least be ascertained, and possibly completely repaired. On Monday morning, June 12th, the pontoon was sunk to a sufficient depth to enable the damaged vessel to be floated over the blocks; the vessel was successfully placed in position by 10 a.m., when pumping commenced, and in a few hours the lifting of the vessel was successfully accomplished, the stem being completely bared down to keel, and her stern being immersed 14 ft. in the water.

In this position the vessel was practically half water borne, and thus any heavy strains on the ship, consequent on having a full cargo, were avoided.

For greater safety a small coffer dam was constructed on the deck of the pontoon around the bows of the vessel, and without difficulty her position has been maintained, all the damaged plates have been cut away, the old stem taken out, and the new one put in place, and the repairs completed.

The importance of this operation cannot be over-estimated; in the ordinary course of events a vessel which had met with such an accident would have had to discharge either the whole or a large proportion of her cargo, involving considerable expenditure of time, first in discharging and then in reloading her cargo; also the cost of warehousing it, and consequent claims likely to follow through breakage of bulk.

In this case at least a fortnight's time has been saved, and the cargo will be delivered to the consignees as it was loaded, which means a very large saving to the claims that might have been made on the underwriters.

THE S.S. "APPOMATTOX."

ON July 12th, the directors and other friends of the Chesapeake and Ohio Steamship Co., Limited, journeyed from London to visit the shipbuilding works of Messrs. Furness, Withy & Co., Limited, Hartlepool, on the occasion of the launch of the steamer *Appomattox*, which is the first of their fleet now building for the American cattle and general cargo trade. To celebrate the event the works appeared to be *en fête* with flags and other decorations. Before the launch took place the directors made a very careful examination of the *Appomattox*, and, with her graceful proportions and elegant cutwater, this vessel presented a very pleasing appearance. The other two sister ships for the company, to be named *Chickahominy* and *Greenbrier*, were also carefully examined, and the directors expressed their satisfaction of the manner in which they were being constructed. The company, when deciding to build these steamers for the trade, were desirous that they should have the most modern appliances for carrying cattle safely and landing them in good condition, and at the same time the structures should be so designed for the deadweight trade that the vessels should be practically unsinkable. Although these ships are built to Lloyd's highest class, the builders had a free hand, and have built them so much in excess of the society's requirements, that it is asserted they are the strongest vessels of this class afloat. The *Appomattox* has two iron decks laid all fore and aft with a shade deck above, so that none of the cattle are exposed to the weather. To get better facilities in the lower hold for stowing cargo, and to give rigidity at the bilges, the vessel is built on the web frame system, with the builders' patent intercostal arrangement. The whole of the main framing is of strong sectional material, so that the top-sides are as strong as any other portion. This sectional framing is most efficiently backed up, more especially at the upper deck, by extra strong plating; all the sheerstrake plates, stringer plates, etc., are increased in width and thickness, and so that none of the butts of shell plating should come near any gangways, ports, or other openings, a large number of shell plates 32 ft. long have been worked into the vessel, and at the midship portion the builders have achieved a feat in shipbuilding which has never been attempted before, viz.: they have succeeded in fitting plates 60 ft. in length. In the construction of the vessel the desire has been to gain strength by dispensing with as many rivetted joints as possible by the use of sectional material, long plates, and extensive cold flanging. The main and fore holds are divided by iron watertight bulkheads, efficiently stiffened by iron longitudinal grain divisions. There are no sluices through these bulkheads, and should the vessel be damaged by collision in any of these compartments it is anticipated that the efficient pumping arrangements will prevent her from sinking; and from calculations made by the builders, even should two of these compartments be open to the sea she will continue to float. She has cellular double bottom all fore and aft for water ballast, and the after peak is also available for a ballast tank. To withstand the heavy weather that is almost always met with in Atlantic trading, the whole of the houses, deck erections, etc., are of iron. The cattle will be carried on two decks with portable hinged fittings, so that on the return voyage from Europe the cattle space can be available for carrying cargo.

Efficient arrangement has been made for the supply of fresh water and for feeding the cattle. The drainage is conducted into special tanks, so that it will not damage cargo in lower holds. The whole arrangement for the shipping and transhipping of cattle and cargo has been done under the supervision of Mr. G. M'Farlane and Captain Manley, late commander of the s.s. *Borderer*, and who has had a very large experience in this trade. For the manipulation of the cargo she has six large steam winches with double derricks, and a large multitubular auxiliary boiler to supply steam to the same. She is fitted with patent stockless anchors housing into hawse pipes, thus dispensing with the laborious process of catting and fishing the anchors, and with the assistance of the machinery the whole operation of lowering and hoisting the anchors can be done by one man. The steam steering gear is fitted aft, controlled from amidships; there is also a stand-by gear aft. She will be rigged as a polemasted schooner. The masts are telescopic so that if necessary the vessel can pass under the Manchester Canal and under the bridges in tidal rivers. The housing of the crew is under the shade deck, thus affording protection during heavy weather whilst attending to the cattle. Most efficient life-saving appliances are fitted, and all the boats are supplied with patent disengaging gear. The accommodation for the captain, passengers, and officers is fitted up in polished hardwood, with beautifully hand-painted panels, executed in a very effective style by the decorative staff of ladies employed by the firm, and the cabin presents an elegant and chaste appearance. The well-known firm of engineers, Messrs. T. Richardson & Sons, Hartlepool, are supplying the propelling machinery for the *Appomattox* and *Greenbrier*, which will be of the triple-expansion type, with two large boilers working at 160lbs. pressure of steam. In designing the vessel and machinery the company have endeavoured to get a good speed out of the vessel, so as to shorten the sea passage as much as possible, and with the powerful machinery fitted and the fine lines of the boat it is anticipated a sea speed of 12 knots will be easily obtained. The second steamer, s.s. *Chickahominy*, will be fitted with propelling machinery from the Central Marine Engine Works. To make the machinery as economical as possible the engineers are fitting a number of their well-known patent appliances. The machinery has been constructed under the supervision of Mr. George M'Farlane, who has had considerable experience with Transatlantic liners and in other steamers in this trade. We hope at a later date to be able to publish particulars of the working of these engines on the trial trip. On leaving the ways the vessel was most gracefully christened *Appomattox* by Mrs. Glynn, of Liverpool, and entered the water amidst the cheers of the large crowd of spectators assembled.

We must congratulate the directors of the Chesapeake and Ohio Steamship Co., Limited, upon their determination to get a fleet of steamers of the strongest and most efficient type, with all the most modern appliances, in order to keep abreast of the times. The fleet is intended to trade between Newport News, Liverpool and London. These ports can be entered in all weathers and at any state of the tide, and possess splendid facilities for loading and discharging cargoes economically. Newport News has the advantage of probably the finest coal in the world, with a splendid railway communication to the most fertile portion of the United States. The directors have appointed as agents at Liverpool the old established firm of Messrs. J. Glynn & Son; at London and Newport News, Messrs. Furness, Withy & Co., Limited; and the shippers may rely upon it that their interests will be well looked after and their goods shipped with dispatch and economy. Previous to the launch the directors and a large number of friends sat down to a luncheon at the royal hotel, West Hartlepool, amongst whom were Mr. W. P. Walker, jun., general traffic manager, Chesapeake and Ohio Railway Co.; Mr. Oscar G. Murray, vice-president Cleveland and Cincinatti and St. Louis Railway Co.; Mr. Walter Glynn, managing director of the Leyland Line, and director of the Chesapeake and Ohio Steamship Co., Limited; and Mrs. Glynn, Liverpool; Mr. J. Mackenzie, L.L., director Chesapeake and Ohio Steamship Co., Limited, Kerfield, Peebles; Mr. C. Furness, M.P., chairman of the Chesapeake and Ohio Steamship Co., Limited; Mr. Thomas Richardson, enginebuilder, Hartlepool; Mr. H. Withy, J.P. and Mrs. Withy; Mr. R. W. Vick, and Mrs. Vick, West Hartlepool; Mr C. W. Rowley, Newport News; Mr. John Wood and Mr. T. H. Tilly, West Hartlepool; Mr. G. W. Sivewright, Hartlepool; Mr. Denny, Mr. George M'Farlane, consulting engineer to the Chesapeake and Ohio Steamship Co., Limited, and Captain Manley, marine superintendent of the company.

VISIT TO THE WORKS OF THE LEEDS FORGE CO., LIMITED, ON JULY 25th.

BY THE MEMBERS OF THE NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS, AND THE HULL AND DISTRICT INSTITUTE OF ENGINEERS AND NAVAL ARCHITECTS.

It has practically become part of the regular programme of the North-East Coast Institution of Shipbuilders and Engineers to have a visit to some important works during the summer recess and having in view the fact that one of the—if not the most interesting and instructive—discussions of the last session was on the subject of Boiler Furnaces, it is peculiarly fitting that this year's visit should be to the home of the Corrugated furnace—as "Fox's" well-known speciality for marine boilers may well claim to be the progenitor of all the patent furnaces now used in the construction of high pressure boilers for marine purposes, of the usual design. Further for comparative purposes, as regards the details of constructing furnaces, seeing that last year's visit was to the works of Messrs. John Brown & Co., Limited, Sheffield, where Purvis' patent furnaces were seen in various stages of progress, it is extremely fortunate for those privileged to take part in that visitation, that they have this year witnessed the manufacture of the Fox's Corrugated Furnaces and Morison's suspension furnaces. Additional interest has also been added to this summer's "outing," by it being jointly participated in by another sister society, viz., the Hull and District Institute of Engineers and Naval Architects.

The Tyneside contingents had the advantage of a special train from Newcastle-on-Tyne, being joined at Durham by their Wearside friends and at Darlington by the Tees and Hartlepool members, the visitors from Hull being timed to arrive at Harrogate shortly before noon, and the North-East Coast Institution party at noon, where they were all entertained to luncheon at Grove House, the residence of Mr. Sampson Fox, the managing director of the Leeds Forge Co.

Amongst those who were present were:—Councillor Robert Thompson, President of the North-East Coast Institution of Shipbuilders and Engineers; John Spier, Esq., Superintendent to the Wilson Line, President of the Hull and District Institution of Engineers and Naval Architects; Sir B. C. Browne; Frank Marshall, Esq.; C. H. Reynolds, Esq.; A. C. Pearson, Esq., of Earle's Shipbuilding and Engineering Co., Hull; H. H. Wake, Esq., of River Wear Commissioners; Chas. Doxford, Esq. (Wm. Doxford & Sons, Sunderland); J. Osbourne, Esq. (Osbourne, Graham & Co., North Hylton); Jas. Dickinson, Esq., and Wm. Carter, Esq., of Palmer Hill Engine Works, Sunderland; A. A. Rickaby, Esq., Bloomfield Engine Works, Sunderland; J. Fothergill, Esq., of West Hartlepool; Wm. Mudd, Esq. (Central Marine Engine Works, West Hartlepool); Geo. N. Arnison, Jun., Esq., Sunderland; Wm. Mills, Sunderland; and J. Duckett, Esq., the Secretary to the North-East Coast Institution.

Sampson Fox, Esq., C.E., Managing Director of the Leeds Forge Co., presided, and proposed the usual loyal toasts, also a double-breasted one, in favour of the Presidents of the two Institutions. He expressed his pleasure at seeing so many old friends present, and was especially glad to see that so many young men, junior members of the engineering and shipbuilding professions, had come to inspect their works.

Robert Thompson, Esq., and J. Spier, Esq., having suitably replied, the health of the host was proposed in felicitous terms by Sir B. C. Browne, and drank with musical honours. Having promenaded through the grounds surrounding Grove House, and visited the stables previous to the luncheon, which gave universal satisfaction, the guests proceeded in their special train to Leeds, where, owing to the dilatoriness of the railway they arrived fully half an hour late at the Armley Station, Leeds, adjoining the Leeds Forge Co.'s Works.

A brief description of the works will be of interest. They were founded just twenty years ago by a private limited company, and for some time were principally engaged in the production of best Yorkshire iron for various purposes. In the year 1889 the business was transferred to the existing company, with Mr. John Scott, of Greenock, for many years associated with the old company as chairman, and Mr. Samson Fox, the founder of the original concern, as managing directors. Prior to this change in the ownership of the works, in the year 1877, Fox's corrugated boiler flues were introduced, and as is well-known, the advent of the triple-expansion engine, and the consequent

higher working pressure required for marine boilers, giving a great impetus to their adoption, as they permitted of the use of lighter scantlings, a feature carrying with it many advantages. For six years the Fox's corrugated flue was manufactured from the best Yorkshire iron, but in the year 1883 the mild steel (Siemens-Martin) having proved itself more reliable and uniform than Siemens' open hearth, furnaces were erected at the company's works, one having a capacity of 16 tons, and two capable of turning out 13 tons of steel at a time. At the same time further plant was added, and still more recently other noteworthy additions have been made, including the water-gas plant and the large 5,000 ton hydraulic flanging press. The latter was laid down for the purpose of producing patent pressed steel frames on Fox's system, for railway rolling stock, in which increased strength is obtained, with reduced weight. These steel frames are flanged on suitable dies at one heat, and the under frames and bogies constructed under this system at the Leed's Forge Works are now in use on fourteen English railways, and have been also largely adopted on the Indian and other Colonial railways. A recent speciality introduced in the railway plant department is a pressed steel axle-box, made from a single plate, thus saving considerable weight and obviating the breakages so common in axle-boxes formed of cast iron.

As usual on all well-ordered visits of the kind, a programme had been prepared embracing the principal operations in the manufacture of Fox's corrugated furnaces and Morison suspension furnaces.

Visitors were not, however, compelled to witness the whole of the programme, but were at liberty to go through the whole of the works and inspect any part of them as they desired. The official programme was as follows:—

	P.M.
Casting of Ingots at Siemens' Steel Furnaces	3·10
Hammering down Ingots into Plate Slabs..	3·25
Analysis and Testing of Samples of Material	3·45
Rolling a Furnace Plate for one of forty-two Fox's Corrugated Furnaces for the Russian Government ..	4·5
Bending a Furnace Plate into cylindrical form preparatory to welding	4·25
Welding ditto by Water-gas process	4·35
Corrugating one of twenty-four Fox's Corrugated Boiler Furnaces for H.M.S. *Talbot*	4·50
Flanging of Fox's Corrugated and Morison Suspension Furnaces	5·10
Manufacture of Water-Gas	5·30
Press Shop Department, and operations of Pressing, Drilling, and Erecting Press Steel Frames for Rolling Stock on Fox's Patent System, including parts for one out of four hundred Bogies for Cape Government Railway	5·40
Flanging at one heat, by Hydraulic Pressure, Combustion Chamber Plates, forming part of ninety-two Plates for the Russian Government	6·10
Manufacture of Pressed Steel Axle-boxes (Fox's Patent system) for Colonial State Railways	6·20
Train to leave Armley Midland Station	7·0

Despite the late arrival the whole of the programme was got through in a highly creditable manner to the staff of the Leeds Forge Co. Every operation was watched with interest. Probably the greatest attention was given to the manufacture of the corrugated furnaces. Evidently there are nice adjustments required to be made in fixing the sizes of plates required for a given size of flue. The plates having been cut to size are rolled into a cylindrical shape, overlapping about 2 in. Then the partially-made flue is brought to the welding plant—the lap is brought between two jets formed of ignited water-gas and air under 2 in. pressure.

About one foot of the lap is heated at a time, and when the required temperature for welding has been reached the flue is brought under the steam hammer, working at from 200 to 300 revolutions per minute, and is speedily welded. There are two distinct welding plants capable of turning out forty furnaces per working day.

The next process is that of corrugating the flues. The tube after being heated to a uniform bright cherry-red is placed in the rolls. The upper roll slides inside the welded cylinder, auxiliary rolls centre the flue, and the two main rolls being brought close together by hydraulic power, impress the corrugations into the plate. At a single revolution of the flue it becomes completely corrugated, and is thus rendered capable of resisting a pressure at least four and a-half times greater than when in its original plane form. The corrugated flue is kept revolving in the mill till such time as it is sufficiently cooled to allow of its removal without any risk of being put out of shape. During this operation the auxiliary rolls also keep revolving, in order to ensure the perfect cylindrical form of the tube.

The next process is the flanging of the flues when this is requisite, and the planing of the edges, after which they are carefully annealed.

The processes in manufacturing water-gas and the peculiarities of this wonderful heating agent also attracted not a few. Incidentally it may be stated that Mr. Fox had his attention turned in this direction by the irregularity of the pressure of the ordinary coal-gas obtained from the town supply at Leeds. And early in the year 1888 the present plant capable of producing 35,000 cubic feet per hour was completed. Water-gas, as its name implies, is a gas produced from water by a chemical reaction which takes place in passing steam through incandescent carbonaceous matter. The fuel used in the retorts at Leeds Forge is coke, which, having been ignited, is in ten minutes rendered incandescent by a blast having a pressure of air equal to 12 ins. of water pressure. Then for four minutes the blast is cut off, and steam is passed through the incandescent mass, the greater part of the oxygen being consumed, the gas is formed and passes to the gasholders. There is an erroneous idea that water-gas has no effluvia, but until it is purified and the sulphate of hydrogen removed, it has—and for heating purposes the gas is used unpurified. When used for illumination no doubt the water-gas is practically odourless, but this source of danger is obviated at the Leeds Forge Works by passing the purified gas through a vessel containing mercaptan, when it has very distinct odour. The arrangement for lighting employed is that of incandescent magnesia on the Fahnejelm system. This consists of a comb composed of magnesia rods suspended by a wire over the gas-burner. The flame renders these rods white hot, producing an intensely bright light. Visitors to the water-gas plant had ocular demonstration of the greater heating power of water-gas as compared with ordinary coal-gas—a rod of iron under fair conditions being alternately subjected to the flame of either gas.

The limits of our space preclude a full description of all that was seen. The Morison suspension furnace was on view in various stages of manufacture, and although only introduced last year, we understand over one thousand of these furnaces have already been supplied. Our readers are already fully acquainted with the design of this furnace, as well as of Fox's corrugated flues, of which over thirty thousand have been fitted in marine boilers, and to the visitors it was clearly apparent that this flue is still in considerable favour. A most instructive visit ended shortly before seven o'clock in the evening, when the visitors returned to their destinations.

STERN TUBE BUSHES.

WE illustrate in the adjo ning diagram the application of bushes of Magnolia Anti-Friction Metal to the stern tube of marine engines, obviating the necessity of using lignum vitæ, or a brass sleeve on the shaft. It will be noticed from the diagram that a recess is provided between the fore and aft bearings and the shaft and the stern tube, which is filled with tallow, through a special tube in the stern tube provided for the purpose, and it is considered to be a very essential and important part of the arrangement. The stern tube is made of cast iron and the white metal bushes are disposed at either end.

We understand the chief object of the design is to prevent the galvanic action which takes place when gunmetal and iron are in contact, and the consequent and rapid corrosion which ensues.

There is no doubt that this arrangement is considerably cheaper than that of gunmetal bushes and lignum vitæ, and its efficiency is, we understand,

vouched for by an eminent firm of engineers who have used this arrangement for a number of years.

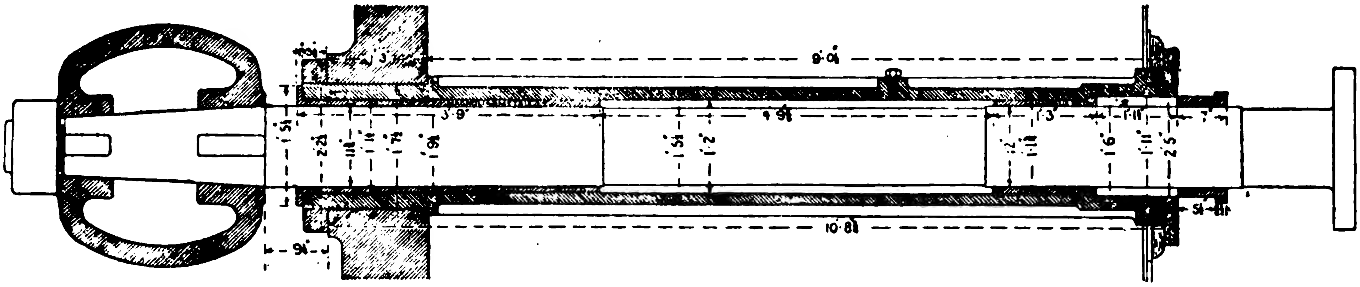
We believe that this arrangement is particularly applicable to ships plying in very sandy waters, as in this case where lignum vitæ and gunmetal are used the latter is soon ground away by the action of the sand which is held by the lignum vitæ, these conditions do not obtain with the white metal.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our own Correspondent.*)

Mishaps of the Mobilisation.

The mobilisation of the greater part of the ships in the Fleet Reserve took place on July 11th and 17th, and was carried out most successfully. It is true that a great deal has been made in certain papers of the comparatively few and trifling defects which some of the ships developed, but on the whole it is obvious that the record is more than fairly creditable. The number of vessels mobilised was ten battleships, mostly of the Coast-guard squadron; five first-class cruisers; twenty-two second-class cruisers; three third-class cruisers; twelve gunboats; and twenty torpedo boats, in addition to some special service craft. These give a total of seventy-six pennants hoisted on the two days, and of the seventy-six vessels thus commissioned against ten only can any complaint or charge be raised; while in all but two cases, these charges are almost frivolous. The *Conqueror*, after she arrived at Portland and was mooring, broke the crown wheel of her capstan engine, and returned to Devonport to make it good. This was the only battleship which had a mishap. The *Pique* on trial developed a crack in one of her furnaces. About twelve months ago, after her contractor's trials, a similar defect was reported, and the cracked furnaces were replaced by new ones; the casuality now reported was not deemed sufficient to detain the ship, and she proceeded to her port of assembly. The *Melampus* also opened out an old defect in her boilers, but it was not serious and did not delay her. Some trifling matters of a similar nature detained the *Sappho* for a a few hours in the Downs, but all was made good by her own engine-room staff. The *Rainbow* fractured a bracket, and heated one of her low-pressure crankheads, necessitating the fitting of new brasses. The *Barracouta* touched the mud when leaving Sheerness. Thus five cruisers only out of twenty-five exhibited defects, and none of these can be said to be of great importance. But one of the twelve gunboats came to grief, which is, in the circumstances, marvellous, for these are the most untrustworthy of ships. The *Jaseur* cracked her low-pressure cylinder, so the authorities promptly paid her off, and commissioned a sister ship, the *Niger*, instead. Two or three of the torpedo boats damaged themselves by running foul of other vessels, which, when it is remembered how little practice at any other time of the year is made with these boats, is not very surprising.



The Preliminary Cruises.

The men-of-war which are taking part in the manœuvres were divided into five squadrons, lettered A, C, E, B, and D, ordered to assemble at Portland, Torbay, Falmouth, Milford Haven, and Bantry Bay respectively. With the exception of half a dozen vessels each squadron assembled at its post by July 16th, and then put to sea for a week's exercise. The A squadron, consisting of the *Royal Sovereign*, *Rodney*, *Nelson*, *Narcissus*, *Blenheim*, *Sappho*, *Pique*, *Naiad*, *Rainbow*, *Intrepid*, *Speedwell*, *Skipjack*, *Salamander*, *Gleaner*, *Spider*, and *Rattlesnake*, left Portland on the 17th, and remained cruising in the Channel until the 22nd, when it put into Torbay to coal. During the week the only vessel that had to repair to a dockyard was the *Speedwell*, with leaky tubes. The B squadron, consisting of the *Anson*, *Thunderer*, *Rupert*, *Immortalite*, *Tribune*, *Iphigenia*, *Mersey*, *Iris*, *Bellona*, *Barracouta*, *Sheldrake*, and *Grasshopper*, left Milford Haven on the 18th, and after calling in at Falmouth to communicate with the A fleet, proceeded to Lamlash, arriving there on the 22nd. The C squadron, consisting of the *Alexandra*, *Superb*, *Benbow*, *Audacious*, *Australia*, *Galatea*, *Terpsichore*, *Indefatigable*, *Melampus*, and *Æolus*, left Torbay, and the D squadron, consisting of the *Swiftsure*, *Hero*, *Aurora*, *Andromache*, *Apollo*, *Brilliant*, *Retribution*, *Forth*, and *Thames* left Berehaven, both on the 17th, the one for Bantry Bay, and the other for Blacksod Bay. In none of these squadrons were any defects of importance discovered. The week was spent in tactical exercises and drills.

Programme of the Manœuvres.

The programme of the manœuvres this year is simple. There are two opposing naval forces, Red and Blue, each is supplied with a fleet divided into two squadrons. The Red side is stronger than the Blue, but by the division of its forces, the Blue squadrons united are stronger than either of the Red squadrons. Ireland is deemed the Blue territory, the west coast of England and Scotland that of the Reds, but Ireland is supposed to be connected with America by a narrow strip of land which forbids the passage or juncture of the Blue squadron *via* the Atlantic. At the moment of the declaration of war the Blue force is distributed, one squadron (C) in Berehaven, one (D) in Blacksod Bay, the former port being south of the forbidden belt, and the latter north of it, with a third squadron (E) consisting mainly of twenty-four torpedo boats in various ports on the east coast of Ireland facing the Red territory. The Red forces are distributed, one squadron (A) in Torbay, and the other (B) at Lamlash, in the Isle of Arran. Hostilities having been ordered the Reds are to take the offensive, and either to bring the Blue forces to action or to reduce them to inactivity, the object in view being so to obtain command of the seas, that a large expedition may be sent across it. I recommend those who care to follow the progress of the war or to understand its lessons to procure the Government Chart of the British Isles, and to mark off the limits of the manœuvre field, which are as follows:—On the north, 50 deg. north latitude; on the south, 49 deg. north latitude; on the east, the western coast of Great Britain and the south coast to 3 deg. west longitude; on the west, 13 deg. west longitude. The space between the parallel of 52 deg. north, and 52 deg. 10 min. north, extending from the 13th meridian west of the Irish coast is a forbidden belt, and is not to be crossed by either side for manœuvre purposes.

Delivery of the "Resolution."

A new battleship of this name has been delivered at Portsmouth from the yard of the Palmer Shipbuilding & Iron Co. at Jarrow. The *Resolution* is a sister ship to the *Royal Sovereign* and one of eight vessels of similar displacement ordered to be built under the provisions of the Naval Defence Act, of 1889. She was begun in that year, and was launched on May 28th, 1892, being constructed and engined entirely by the contractors. The *Resolution* will be a 17½ knot ship of 14,150 tons displacement, carrying 900 tons of coal, which it is anticipated will give her a radius of action of 5,000 knots at 10 knot speed. She is built entirely of steel, and the hull is divided into 250 watertight compartments, inclusive of the double bottom which extends under engine-room, boiler and main magazine spaces There are long-

tudinal bulkheads separating the engines and boilers, and at the sides forming wing passages and coal bunkers. The armoured protection of the *Resolution* consists of sloping decks of steel $2\frac{1}{2}$ in. in thickness, extending under water from the bow and stern for about 70 feet aft and forward respectively; where these decks end a deck of of 3 in. steel begins and connects them, but is horizontal with sloping edges, and is at load draught above the water line. Above the level of this protective deck is a belt of armour, steel faced, 250 ft. long and on the midship section of the vessel. This belt varies from 14 in. to 18 in. in thickness, and is 8 ft. 6 in. deep. Above this belt is another 4 in. thick, extending 144 ft. over the midship section, and terminating in a 3 in. athwartship bulkhead, in rear of the barbette towers. The arrangement of the ship is the same as that of the *Royal Sovereign*, and the ship is lighted throughout with electricity; the installation including 700 Swan lamps and five search lights of 25,000 candle-power.

Chatham Dockyard.

The chief event of the month has of course been the mobilisation, when pennants were hoisted on 23 vessels on the same day. This matter has, however, more to do with the Fleet than the Dockyard Reserve. The ships all got away very creditably and without mishaps of a serious nature. It is hoped that within a short time a factory will be erected here for the construction of engines, the foundations for such a building having been laid some time back. The experiment of building engines for ships of war in the Dockyards was originally tried at Devonport where two gun-vessels of the *Rattler* type were supplied with their machinery and with great success. Then at the same yard the *Lapwing* and the *Ringdove* had their engines made and these essays encouraged the naval authorities to extend operations and Sheerness engined the gunboats *Gossamer* and *Gleaner*. Then the *Phœbe* was supplied with engines of 7,000 H.P. for the *Astræa* were put in hand. Similar engines to the last named were at the same time ordered at Portsmouth for the *Fox* and at Chatham for the *Forte*. Lastly the engines of 9,900 H.P., for the three ships of the *Minerva* class are to be built at the yards where the vessels themselves will be constructed, engine building may therefore now be considered a feature of Dockyard work, and the yards cannot long remain without proper factories for the purpose. The *Agincourt* here, for the refit of which ship a sum of £43,000 has been allotted, is to be completed as early as possible in order that she may be commissioned. She is being supplied with new boilers and quick-firing guns and to expedite the work more men have recently been put upon her. Captain Holland has succeeded Admiral Rice here in command of the Fleet Reserve, and Lord Charles Beresford Captain Andoe—who has gone to the Mediterranean to command a ship—in charge of the Dockyard Reserve.

Launch of the "Antelope."

A new torpedo gunboat of this name was launched at Devonport, on July 12th, the ceremony being performed by Miss Florence Crocker, a daughter of the Chief Contractor of the Yard. The *Antelope* is a steel-built twin screw vessel of 810 tons displacement, having engines of 3,500 indicated H.P., built by Messrs. Yarrow, which are intended to give her a speed of 19·25 knots an hour. Her length is 230 ft., beam 27 ft. and draught of water 8 ft. 9 in. Three sister ships of the *Antelope* are manœuvring this year, the *Jason*, *Circe*, and *Niger*, and their performances will be watched with much attention. The vessel was laid down in October, 1889, and has been a very long time under construction. She is, however, in a very advanced state, the bed plates, funnels, boilers and auxiliary engines with shafting and propellers being already fixed while the main engines are ready to go on board. The propelling machinery consists of two sets of triple expansion, surface condensing, vertical engines, four locomotive boilers to work at a pressure of 160 lbs. on the square inch, and two three-bladed propellors making 250 revolutions per minute. The auxiliary machinery consists of two air-compressing engines, one dynamo, one capstan engine, four feed engines, two fire and bilge engines, two Weir's evaporators, two Kirkaldy condensers, one Weir's & Caldwell steering engine, and two circulating engines. The *Antelope* is to be ready for her steam trials in October.

Portsmouth Dockyard.

One battleship, six cruisers, two gunboats, seven torpedo-boats, hoisted the pennant at this yard on the 11th, and one cruiser on the 17th. The *Ramillies* battleship with the *Gibraltar* and *Endymion* cruisers were also ready for commissioning, but crews for these vessels, numbering 1,500 men, were not forthcoming, everything worked most smoothly, and no serious hitch occurred. The *Grafton*, another first-class cruiser, which has been running her trials in the Channel, does not come here as at one time expected, but has returned to Chatham. The *Resolution* described above has, however, been delivered from Messrs. Palmers' works to complete. It is proposed to convert two wings of the convict prison in this Dockyard into a naval Barracks, and arrangements with this project in view are being made between the Admiralty and the civil authorities. Work is being pressed on with the ships here in the Dockyard Reserve, but the *Sultan* cannot possibly be ready at the present rate of progress during this financial year. It is stated that she is to have a belt of cork at the water-line placed outside of the hull to increase her stability, but if so it would seem as if this method must necessarily diminish her speed. The *Devastation* will be ready to relieve the *Nelson* by the end of September.

The "Minerva" Class of Cruisers.

The plans and specifications for a new class of cruiser, the construction of which was promised in the First Lord's memorandum this year, have been received at the dockyard. Three of the type named *Minerva*, *Eclipse*, and *Talbot*, are to be built at Chatham, Portsmouth and Devonport respectively. The Portsmouth ship will be laid down on the slip vacated by the *Fox*, that at Chatham on the slip from which the *Apollo* was launched, and the third at Devonport in the place of the *Bonaventure*. They will be second-class cruisers and improvements of the *Astræa* type, having an additional displacement of 1,240 tons. In length they will be 350 ft., beam 53 ft., and have engines of 9,600 H.P. The proposed armament is five 6 in., six 4·7 in., eight 6 pounder, and one 3 pounder, all quick-firing guns. They will also be provided with four torpedo tubes, two above and two below water, and will carry eleven boats, one pinnace, one steam cutter, two pulling cutters, one steam barge, galley, gig, whaler, dingy and two skiffs.

Devonport Dockyard.

The mobilised ships at this port were all turned out with creditable rapidity, and it is reported in better condition so far as appearance goes than some of the vessels from the Eastern yards. There was, however, the usual crop of small mishaps, and though the defects were mostly made good by the artificers of the ships, the people at Keyham also had to undertake some of the repairs. The heaviest job was the *Conqueror's* capstan gear, but the *Pique* and *Melampus* cruisers, the *Speedwell* gunboat and a couple of torpedo boats also came in for assistance. The refit of the *Northumberland* at Keyham is making good progress, and will be completed early next year. The *Undaunted*, which ship recently paid off here, is also having defects made good, and the *Warspite* is in the same category. In November the *Hermione* is to be launched, she is a sister ship to the *Astræa* and *Bonaventure*, both of which cruisers are making ready for their steam trials. The last-named vessel is to make her machinery essays before having her tubes ferruled, but will undergo this precautionary measure after they have been finished. Her machinery is supplied by Messrs. Hawthorne, Leslie & Co. The *Antelope* gunboat is to complete for sea at once. There is general complaint made here about the lack of new plant, and such machinery as overhead cranes to the building sheds, and other appliances for transporting heavy weights. At the Naval Ordnance Depot at Stonehouse, where the want of a crane for lifting heavy guns has long been felt, a 40-ton crane is now to be supplied. If similar measures were taken at the dockyard it would certainly conduce in the end to economy.

Trials and New Commissions.

Apart from the vessels ordered to hoist the pennant for the mobilisation, and the commissioned trials they mave made, there has been little doing to report under this heading. The *Invincible's* crew turned over to the *Australia* on July 2, and the *Bellerophon* to the *Rupert*, these vessels having now joined the Coastguard squadron. As a second part of the mobilisation when more men were forthcoming, owing to the return of paid off crews from abroad the cruisers *Latona*, *Thetis*, *Spartan* and *Pearl* were commissioned and sent to join the mobilised fleets. The *Spartan* and *Naiad* are the first ships to be supplied entirely with cordite charges for their 6 in. quick-firing guns. The *Spanker* gunboat recently made a trial of her engines when with an air pressure of ·66 of an inch, 1,158 I.H.P. was obtained, and a speed of 11·8 knots. The bottom of the ship was very

foul, but for an 18 knot gunboat, which was the promise of these craft for sea speed, this can scarcely be called satisfactory. The Admiralty have ordered from Messrs. Belleville, of St. Denis, a complete set of eight tubulous boilers which are to be fitted in the *Sharpshooter* next October, for the purpose of carrying out an exhaustive series of trials. Messrs. Clarke, Chapman & Co., of Gateshead-on-Tyne, have been instructed to deliver at Devonport one of their seamless steel boats for trial in one of the troopships. The Teignmouth Ship and Yacht Co. have secured the contract for building a number of light gigs for man-of-war use.

Pembroke Dockyard.

The fitting of the rigging of the *Cambrian* at this yard has commenced, and she will then go to Devonport to have her tubes ferruled. Surprise is often expressed here that the authorities do not make this a fitting and repairing as well as a building yard. Its position out of the range of torpedo-boat attack gives it an advantage over the Channel ports, and many other strong arguments could be adduced for such a step. Although no ships commission here, a portion of the mobilised fleet always puts into the Haven, and among other vessels here lately the *Anson*, *Thunderer*, and *Iris* are all Pembroke-built ships. Mr. W. H. White made an inspection of the ships under construction here recently, and expressed himself well satisfied with the progress made and the work put into them. It has at last been decided to erect a semaphore on the Stack Rock Fort, the delay having been caused by the objections raised by the military authorities, who allege that so doing will make the fort conspicuous. The same objection was raised at several forts on the south coast, but it is most nonsensical, for apart from any semaphore, the positions of the forts are about as well known to everybody at home and abroad as that of the Nelson monument in Trafalgar Square. However, the semaphores are to be on hinges and capable of laying down, and so with this compromise all parties are said to be satisfied. The Stack Rock fort commands the Haven, and is capitally situated for the transmission of signals from Dale harbour up to the look-out station in the dockyard.

The Injury to the "Camperdown."

On the arrival on July 7th of the *Camperdown* at Malta, after her unfortunate collision with the *Victoria*, she was docked, and an examination made of the injuries she had sustained. These were found to be far less serious than was expected. They consisted of a hole in her port bow about ten feet by six, while the stem was cut right through about six feet above the ram and twisted over to port. The ram itself and the armoured deck are uninjured, but the figure head is missing. The hole in the bows had been temporarily covered with three iron plates by the divers of the squadron. The method of fixing the plates is thus described:—The divers wedged a dozen or more iron stanchions inside the collision compartment, and when these were firmly fixed the plates were secured to them by long bolts having hook shaped ends. The straight end of the bolt was passed through a hole in the covering plate and secured by a nut. The smaller apertures were filled with wooden wedges tightly driven, and then the whole fracture was covered by a mat and canvas. A new stem piece for the ship will have to be forged, and this work may have to be done at home, but the dockyard authorities at Malta have energetically set about the business of repair, and every effort is being made to expedite matters. Gangs of men are working night and day, orders having been sent from hence to get her finished as speedily as possible, and an apparently optimistic estimate of the time to be occupied in making good defects is nine weeks.

Watertight Doors and Longitudinal Bulkheads.

There has been, and very naturally so, considerable comment and animadversion in the lay press on the subject of watertight doors and longitudinal bulkheads. That the greater part of this criticism is written by badly-informed persons must have been apparent to the professional eye, but how badly informed perhaps is not known, and a few facts upon the subject may therefore be useful. In the first place there was no longitudinal bulkhead, in the ordinary acceptation of the term, in the *Victoria* forward of the athwart ships bulkhead before the foremast stokehold. This bulkhead was the one about which the late Fleet Engineer said to Captain Bourke: "There is no water abaft the fore stokehold bulkhead. Moreover in this bulkhead *there were no doors* whatever. Abaft this bulkhead there were two longitudinal bulkheads with a narrow passage between them running fore and aft. What most likely happened was that the mass of water in the fore compartments was, when the ship went ahead, brought with great force against this doorless bulkhead, and that already weakened by the shock to the armoured deck with which it was connected, it gave way, letting the water into the starboard stokeholds and engine-rooms with a rush. The longitudinal bulkheads, especially if the connecting doors were closed, would prevent the water speedily distributing itself to port, and would give the ship such a lilt that the maindeck ports being open ready access to more water would be found there, and then the ship was bound to turn turtle. The loss of the ship may therefore be with some good ground attributed to the structural weakness of the athwartships bulkhead before the fore stokehold, and as the whole of the later ships of the Navy are no stronger in this respect, it will perhaps be as well if this bulkhead is at once strengthened. That a very slight shock to the hull causes the supposed watertight compartments to leak like a sieve was well exemplified in the cases of the *Sultan* and the *Howe*, while even in the *Royal Sovereign* the putty stopped rivet hole is not altogether unknown.

Sheerness Dockyard.

The *Renard* torpedo gun-boat built by Messrs. Laird Bros., of Birkenhead, has been delivered at this yard for completion. This vessel is one of the improved *Sharpshooters* like the *Antelope* just launched at Devonport, and the *Onyx* lately delivered here by the same firm. They are of 810 tons displacement, but except that their funnels are longer and encased, they are very like their prototypes. The *Leda*, a similar ship which was taken out here for a three hour forced draught trial, to determine the acceptance of her machinery from the contractors, Messrs. J. Penn & Sons, was obliged to put back owing to leaky tubes in the foremast boilers. She is having her defects made good, and will then be tried again. Her natural draught trial was quite satisfactory. The *Jaseur*, another boat of this type which in commissioned trial cracked the low pressure cylinder of the port engine, has been demobilised and placed in dock, her place being taken by the *Niger*, upon which vessel strong gangs of fitters, boilermakers, coppersmiths and painters were put to work as soon as orders were received that she was to hoist the pennant. She was got ready with most creditable alacrity, and joined the A squadron at Torbay, on July 21st. Of this class the only boat, which is not yet in the dockyard hands, is the *Speedy*, launched from Messrs. Thornycroft's yard at Chiswick the other day. But if the reports upon the vessels of this type which have been mobilised are satisfactory, it is expected that more will be put in hand next year. The mishap to the *Leda* was quite unexpected, Messrs. Penn & Sons, who are responsible for her machinery, having also engined the *Scylla*, *Sappho*, *Circe* and *Alarm*, all of which vessels made most satisfactory trials. The repairs of the *Rambler*, surveying ship, have been taken in hand here, but they will be proceeded with quite leisurely, as she is not required for service until next year.

The Repair of the "Howe."

A correspondent at Chatham writes:—Great precaution was necessary in docking the *Howe* so as to place her safely on the blocks. Her guns and all removable weights were taken out and every measure taken that could be devised to simplify and overcome the difficulties occasioned by her broken and unevenly shaped bottom. Since she has been got into dock the workmen in two shifts have been employed upon her day and night, and there can be no question that the Admiralty are in earnest in endeavouring to get her completed as soon as possible. Indeed, wonderful progress has already been made, both in opening out her bottom, removing all the plating and frames with which the rents were temporarily repaired and also in preparing for rebuilding her. There can be no doubt, however, that it will prove a long job, for the damage is not confined to those parts where the ship actually took the rocks, but have extended and spread in an astonishing way. The midship sections and the bottom, for a length of 150 ft. have been driven inwards to the extent of several feet, while both inner and outer bottoms are shattered and twisted in a most marvellous manner. That a great part of this damage as caused by the attempt to drive her over the rock seems very probable. Three-fourths of her bottom will, however, have to be made good, and how it is possible to do this and get the vessel to the Mediterranean again by October next is not very clear.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty, from June 26th, 1893, to July 25th, 1893 :—

Bath, G. C., engineer to the *Wild Swan*, to date July 20th.
Bell, Henry F. (probationary), assistant engineer to the *Nelson*, to date July 1st.
Brown, Thomas F. (probationary), assistant engineer to the *Latona*, to date July 1st.
Cooke, Herbert W. C. (probationary), assistant engineer to the *Naiad*, to date July 1st.
Cox, Frank S. (probationary), assistant engineer to the *Dreadnought*, to date July 5th.
Davies, William R., engineer to the *Sirius*, to date June 26th.
Davis, W. P., fleet engineer, has been placed on the retired list.
Ellis, M. W., chief engineer has been advanced to the rank of staff engineer in Her Majesty's fleet.
Fielder, J., chief engineer, has been advanced to the rank of staff engineer in Her Majesty's fleet.
Gedge, Henry A., acting engineer to the *Traveller*, to date July 11th.
Guyer, Frank (supernumerary), probationary assistant engineer to the *Pembroke*, to date July 1st.
Haggarty, George A., engineer to the *Howe*, to date July 3rd.
Hammond, Cyril E. J. (probationary), assistant engineer to the *Rainbow*, to date July 1st.
Hammond, H. T., chief engineer, has been advanced to the rank of staff engineer in Her Majesty's fleet.
Howe, Percival C. W (probationary), assistant engineer to the *Swiftsure*, to date July 1st.
Humphreys, Henry, engineer to the *Hazard*, to date July 8th.
Hutchings, Frederick H., assistant engineer to the *Speedy*, to date July 7th.
Jacobs, Frederick G., engineer to *Torpedo-boat 81*, lent, to date July 11th.
Kimber, John L. (probationary), assistant engineer to the *Indefatigable*, to date July 1st.
King, Quentin W., chief engineer to the *Scout*, to date May 10th.
King, Q. W., engineer, has been promoted to the rank of chief engineer to Her Majesty's fleet
Legate, William P. (probationary), assistant engineer to the *Intrepid*. to date July 1st.
Odam, Edwin K., chief engineer to the *Fox*, to date June 29th.
Palmer, A., staff engineer has been advanced to the rank of fleet engineer in Her Majesty's fleet.
Palmer, Alfred, staff engineer to the *Warspite*, to date June 25th.
Paterson, James A., (probationary), assistant engineer to the *Brilliant*, to date July 1st.
Pill, J. H., engineer has been promoted to the rank of chief engineer in Her Majesty's fleet.
Short, Edward A., engineer to the *Beagle*, to date June 26th.
Spalding, Andrew, fleet engineer to the *Warspite*, temporary, to date June 25th.
Stewart, Charles E., fleet engineer to the *Howe*, to date July 3rd.
Thomas, Josiah P., staff engineer to Devonport Yard, to date July 1st.
Thomas, E., chief engineer, has been advanced to the rank of staff engineer in Her Majesty's fleet.
Westbrook, Walter S., assistant engineer to the *Australia*, lent, to date July 12th.
Wisnom, William M'K., engineer to the *President*, additional for temporary service at the Admiralty, to date June 29th.
Wormald, George (probationary), assistant engineer to the *Galatea*, lent, to date July 11th.

The Glasgow Patents Co., Limited, announce that they have re-opened City Offices at 11, Bothwell Street, near the Central Station, Glasgow. The Registered Office is still at the Works, 120, Great Wellington Street, Kinning Park.

Examination of Marine Engineers.—At the Board of Trade Examinations, held at North Shields on July 11th, 12th, and 13th. Mr. H. G. Scott (son of the late Mr. John Scott, jun.), of South Shields, passed for Extra First Class Engineer. He was prepared by Mr. W. H. Thorn, 5, Waterville Terrace, North Shields, and is the only successful candidate at this examination throughout the kingdom. He is the twenty-first pupil who has passed for the Honorary Certificate from the above establishment.

HOAR & BROWN'S HARDWOOD MARKET REPORT, JULY 21st, 1893.

TEAK—	LOGS. Loads.		PLANKS. Loads.		BLOCKS. Loads.		TOTAL. Loads.
Stock, 1st July, 1893	7,782	...	3,079	...	26	...	10,887
Landings	*nil*	...	126	...	*nil*	...	126
	7,782	...	3,205	...	26	...	11,013
Deliveries	725	...	171	...	*nil*	...	896
Stock, July 21st, 1893	7,057	...	3,034	...	26	...	10,117

The position is unchanged except that there are more enquiries about at the moment, and should these result in orders being placed, a considerable quantity of stock will be moved, which may be the cause of a rise in values very shortly. There have been no further "without reserve" sales, the very low prices realized at these ventures having rendered it extremely unlikely that any similar trials will be made during the present depression. One arrival of 1,100 loads from Rangoon is reported, but will not check any immediate upward tendency, as the wood is mostly under engagement. A cargo of Bangkok, it is understood, has been sold for the Continent at a high figure in preference to being consigned to this market.

The deliveries have been:—

Planks are now at their lowest, and the present appears to be a most favourable opportunity to purchase for requirements. Stocks are getting lighter, although the quantity now here is ample for a considerable time without fresh imports.

Mahogany.—The price of 24 in. and upwards still remains high, and is likely to advance, for anything of good quality, and it is now difficult to obtain this class of wood, the stocks being very small. The market is pretty full of Spanish wood and many finely figured logs are now being offered, commanding full prices, and some good business has been done. Later on a quantity is to be offered at public auction for absolute sale. There is nothing much doing in Cuba, and the market is heavily stocked with small wood which is scarcely enquired for.

Panama and African are going very low, especially the latter, which finds but little favour in London.

Cedar.—Prices keep up in consequence of small supplies, which take the form of cigar-box wood. Long boat-building logs would command high figures.

American Walnut.—Some very low quotations are made. due to the inferior quality of the parcels lately landed, which are almost unfit for any use whatever. Anything good still pays to import, and there is plenty of opening for further shipments.

Kawrie Pine has been going off well, and Sequoia has also been having a fair run at low figures.

Business is much restricted throughout, and complaints regarding the dulness of trade are almost universal.

Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley, have received an order from the Port Commissioners of Calcutta, through Mr. W. Duff Bruce, C.E., 17 Victoria Street, London, for the supply of a powerful dredger similar to one recently constructed by the same firm for the Port of Calcutta. She is to have dimensions 155 ft., by 32 ft., by 11 ft., and to be capable of dredging 800 tons per hour from a depth of 35 ft. She is to be fitted by the builders with all their most modern improvements.

The Hook of Holland Route to the Continent.—The Great Eastern Railway Co. have just given Messrs. Earle, of Hull, an order for two twin-screw steamers for their Continental traffic via Harwich and the Hook of Holland. These vessels will be of the same speed and type as the steamer *Chelmsford*, which was placed on the service on the 1st of June last, with greater beam and length, in order to improve the passenger accommodation.

New Shipbuilding Yard at Leith.—A new shipbuilding and engineering establishment is about to be started in Leith. A large piece of ground has been leased from the Leith Dock Commission at the north side of the Queen's Dock, on which workshops and engineering premises are being erected. Already some of the machinery has been placed in position. The new firm is said to have made a good beginning by securing an order to build about a dozen barges for the Thames.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(From our own Correspondent.)

THE month of July is always a very slack month in the shipbuilding and engineering trades here owing to the intervention of the trades' holidays in the Glasgow, Greenock, and Port-Glasgow yards, and as these holidays extend for ten days or so it very materially affects the outputs, which, however, under any circumstances have been particularly small. The slight increase in the demands for new tonnage has, however, shown signs of being maintained, and though few new orders have been booked, still a number of specifications are out, and the drawing office staffs, in most yards, are being kept fairly busy on estimates which are bound to lead to something. Messrs. Rankin & Blackmore, Greenock, have booked a contract to supply the Lancashire and Yorkshire and London and North-Western Railway Co. with two twin-screw hopper steamers of 300 tons hopper capacity each, for their joint service at Fleetwood. Messrs. Murdoch & Murray will supply the hulls whilst Messrs. Rankin & Blackmore supply engines and machinery. On the East coast Messrs. W. B. Thomson & Co., Limited, have contracted to build a steamer for the Glasgow and Liverpool Royal Steam Packet Co., for their coasting trade. The new steamer is to be larger than the *Princess Beatrice*, built this year on the Clyde. She will be a large carrier, and have excellent passenger accommodation, with all the latest improvements, including complete electric light installation, &c. Messrs. Ross & Duncan have received the order for a pair of compound surface condensing engines of 100 H.P. for a steamer building on the Clyde.

The dull times in the shipping trade do not seem to have seriously affected Messrs. Burrell & Son, of Glasgow, as they have issued specifications to several Clyde yards for two new 5,000 ton cargo boats. If this order is placed, Messrs. Burrell will have eleven new boats, of close on 50,000 tons capacity, building at one time.

The shipping returns for the first half of the present year are now made up, and though they show a large drop compared with the three previous years, the decrease is not so marked as was anticipated at the close of 1892. Below we give a table of the outputs in Scotland for the first six months of the past four years:—

	Six months' Tons.
1893	132,691
1892	210,884
1891	190,999
1890	208,675

Of the above output of 132,691 tons the Clyde contribute the lion's share of 118,699, which is considerably above the outputs of the years 1888, 1887, 1886, 1885, and also above 1880 and 1879. With these exceptions, however, it has been exceeded in every case during the past 15 years.

The market for shipbuilding materials has during the past month been firmer, and orders for both home and foreign account more numerous. Thousands of tons of angles and bulbs have been rolled off during the month, and orders are still numerous. Plates are only moderately inquired for, though one or two good orders for boiler plates have been placed. Ship-plates are being done at £5 5s. per ton, and angles at £4 12s. 6d. to £4 17s. 6d. per ton, delivered at Clyde shipyards. The pig-iron market is firm, and prices maintained. There are now 69 blast furnaces in operation in Scotland as compared with 74 at this time last year.

As indicative of the wide difference which may exist, even in these times, between the estimates of shipbuilders, it may be of interest to our readers to note that in some offers made recently for a contract for several sailing ships there was a disparity of £15,000 between the highest and lowest.

Messrs. J. Stewart & Son (Limited), of the Blackwall Iron Works, have received an intimation that the Lords Commissioners of the Admiralty have, after inspection, placed their name on the Admiralty list of firms who may be called upon for tendering for the construction of engines and boilers, also for hulls of tugs tank vessels, barges, stern wheelers, &c., and also for mast-making.

TRADE NOTES FROM THE TYNE, WEAR, TEES, HARTLEPOOLS, &c.

(From our own Correspondent.)

THE TYNE.

Shipbuilding.—The tendency towards improvement in the shipbuilding industry, which was referred to in last month's Notes, has become more strongly marked, and a number of orders have been placed with leading firms on the Tyne. Though the speculative element would still appear to be more or less in operation, some guarantee for the genuineness of the improvement is afforded by the fact that nearly all the idle tonnage has been taken up, and such an anomalous conjunction of circumstances as an increase in the number of orders for new vessels, while whole fleets of old ones were lying idle through scarcity of work, can no longer be said to exist. Among the orders placed this month, may be mentioned one for a couple of large oil-carrying steamers given to the Tyne Shipbuilding Co. by Messrs. Hunting & Son, of the Quay-side, Newcastle. These vessels, it is understood, will constitute the nucleus of a fleet to be run in the petroleum trade, by a newly established company. The machinery of the vessels will be supplied by the Wallsend Slipway and Engineering Co., Limited. The Palmer's Shipbuilding and Iron Co., Limited, have obtained from Messrs. Alexander & Co., of Liverpool, for whom they have during the past few years built a number of vessels—an order for a steel steamer of 6,000 tons carrying capacity. Rumour credits the Palmer's Co. with the possession of several other orders of importance; but respecting these, nothing definite can at present be said, though it is to be hoped there is some foundation for the statements that are current. There is at present only one large vessel on the stocks of the Jarrow Yard; but at the company's Howdon establishment, there are three vessels in progress. Messrs. John Readhead & Sons have obtained from the South Shields Steam Shipping Co. directors, an order for a cargo steamer of 4,800 tons deadweight carrying capacity, for which they will also supply the engines. This is the second vessel ordered from Messrs. Readhead by the same owners, within the past few months. Messrs. Robert Stephenson & Co., Hebburn, have received from Messrs. McIntyre & Co., Newcastle, an order for a steamer of over 4,000 tons carrying capacity, which is to be similar in all respects to the s.s. *Resolve*, built by Messrs. Stephenson for the same owners, towards the close of last year. The *Resolve*, it may be stated, has recently been disposed of to a firm of foreign shipowners. Messrs. W. Dobson & Co. have sold to a Hamburg firm a vessel which had stood in an almost completed state some time upon the stocks, and Messrs. Schlesinger & Davis have disposed of a sailing ship which was launched by them last year. Messrs. Armstrong, Mitchell & Co. are putting down a cruiser of the largest class (supposed to have been ordered by a foreign Government) at their Elswick yard, where there is also another vessel of the same type nearly ready for launching. At the company's Low Walker yard there are six large vessels on the stocks—most of which are oil-carrying ships—and others are being fitted out on the river. Among the latter is a very superior vessel, which was sold some time ago to the North German Lloyd's. Messrs. Wigham Richardson & Co. have succeeded under circumstances of very close competition, in obtaining from the Tyne Steam Shipping Co. the order for a fast passenger steamer to replace the s.s. *Londoner*, on the regular weekly service between London and Newcastle. The *Londoner*, it may be recollected, was lost by collision, while on her passage from Newcastle to London some time ago. Messrs. Richardson have all their berths occupied, and have other vessels in preparatory stages; the firm being fully as busy as at any period of its long and honourable career. The whole of the vessels on hand are of a superior class, a circumstance which renders the exceptional briskness of the establishment at a time like the present all the more remarkable. Messrs. C. S. Swan & Hunter launched during the month a cargo steamer of exceptionally large dimensions, ordered by Sunderland owners for general trades. The vessel has a very complete equipment of modern accessories to facilitate the work of loading and discharging, and is fitted with a powerful windlass and other appliances by Messrs. Emerson, Walker & Thompson Bros., Gateshead. The firm have just laid down the keel for another large vessel, and have two others in preparatory stages, besides

two that are now on the stocks in course of framing and plating.

Messrs. Hawthorn & Leslie have now four berths occupied, three of the vessels on the stocks being of exceptionally large tonnage, and all of them being of a superior class. The yard is consequently very busy for the time being; but the future outlook is somewhat doubtful, as it is understood the firm have no other contracts to proceed with. At the Edwards' Shipbuilding Co.'s yard frame turning for one of the vessels ordered by R. S. Donkin, Esq., M.P., has been commenced, and it is expected that the construction of both vessels will very shortly be in progress. The large pontoon dock, of which a brief description was given in last month's MARINE ENGINEER, is nearly completed, and will, it is expected, be ready for delivery at Manchester by the appointed date. It may be stated that the whole of the brass and copper fittings connected with the machinery of the pontoon have been supplied and fitted by Messrs. Swinburne & Sons, Wallsend. Mr. Edmund Sharer, the respected general manager of this establishment, is about to sever his connection with the Edwards' Co., having accepted an appointment to a similar position at the yard of the Fairfield Shipbuilding Co., Govan. After a seven weeks' strike against a wages reduction of 1s. per week, the Tyne ship-joiners have returned to work, the employers having decided to withdraw the claim for a reduction. In arriving at this decision, the employers were actuated by a desire to avoid discharging numbers of other workmen, which step would have been inevitable had the joiners' absence from work been further prolonged. This act of consideration on the part of the employers is not likely to go unappreciated by the other sections of workmen, who recognising the depressed state of the trade, willingly submitted to the reduction two months ago.

Engineering.—The marine engineering works at St. Peter's, Low Walker, & Wallsend, continue very busy, and similar establishments in other parts of the district are showing symptoms of improvement. In the locomotive shops there is very little doing; but iron founders and forge proprietors have more work in hand, and steel works at Newburn and Jarrow are busier than they were some weeks ago. Messrs. John Mills & Co., of the Walker Gate Brass and Copper Works, have decided to adopt the eight hours per day working system, and have given notice to their workmen that the change will commence immediately. It remains to be seen whether the results will prove satisfactory; but it may be said without prejudice to any interest that such experiments as these are somewhat hazardous, as it would be found difficult to revert to the former method of working, should such a course at any time seem desirable. The works of Messrs. H. Watson & Sons, at Walker Gate, are well employed, and likely to continue so, as the demand for most of the specialities manufactured by the firm is well sustained. Messrs. John Abbott & Co. have received a further order (a former one being nearly completed) for hydraulic machinery for the Southampton docks. Messrs. Crosier & Mills are showing a number of useful machines by Richards, of Manchester, and other makers, in their new offices in Collingwood Street, Newcastle, and are doing an active business in the sales of various specialities for which they are agents. The representative of Messrs. W. Reid & Co., of 112, Fenchurch Street, London, has experienced a large demand lately for the different specialities manufactured by the firm, including Reid's automatic reducing valves, sight feed lubricators, self-lubricating sheaves and pulleys, &c.; a number of these articles are being sent out from the depot at No. 1, Akenside Hill, daily. Messrs. Noble & Lund, machine tool makers, Forth Banks, have decided to remove their business to Felling, where they are erecting new premises covering an area of about 6,000 square yards. After the removal, which will take place in October next, they contemplate developing their business very largely, and will include among their specialities of manufacture, various shipbuilders' and engineers' tools, which, on account of limited space, they have been unable to take in hand hitherto. The two "Yaryan" evaporators which have been supplied to the Japanese cruiser *Yoshino*, through the Newcastle agents, Messrs. George Noble & Co., have on the occasion of a recent steam trial of the vessel given excellent proof of efficiency, their capability of maintaining the necessary supply of feed water to the boilers, and at the same time providing an abundance of good drinking water for the crew, being satisfactorily demonstrated. It is perhaps necessary to explain that the arrangement for producing the drinking water is separate and independent of that by which the boiler feed is kept up. In speaking of the *Yoshino*, it is as well to state that the piston rods, &c., of the engines were packed by the Combination Metallic Packing Co., of Lombard Street, Newcastle, who also have packed the engines of the *Resolution*, *Revenge*, and many other war vessels. The works of Messrs. Clark, Chapman & Co. are just now very busy, not only in the engineering department, but also in the electric-lighting shops. At the works of Messrs. Carrick & Wardale business is also satisfactory, there being a good many orders on hand for steam-feed pumps and other specialities.

THE WEAR.

Shipbuilding.—Up to the present it does not appear that the builders of the Wear have participated, to any marked extent, in the distribution of new orders for ships that has lately taken place; but as several Sunderland vessels that had been laid up, have recently obtained charters, and a very large diminution in the number of idle vessels at other ports having also taken place, it may be hoped that work in the local building yards will soon receive a much needed stimulus. Though the majority of the yards are just now undeniably slack, it is gratifying to be able to state that in one or two cases the future outlook is encouraging. Messrs. W. Doxford & Sons are reported to have secured an order for a steamer, similar in design and dimensions to the *Samoa*, built by them to order of a Liverpool firm last year, and which is said to be the largest cargo steamer afloat, having a carrying capacity of over 9,000 tons. This, with the other work on hand, and in preparation, will doubtless provide full employment for the hands at that establishment during the remainder of the year. Messrs. Short Brothers have a fair amount of work on the stocks, and Messrs. J. L. Thompson & Sons have four vessels in various stages of progress, and have just laid the keel for a fifth. Mr. Laing has four vessels in progress, but it is understood that one of these is being built on the speculative principle. Messrs. Priestman & Co. have two vessels in advanced stages; while at Messrs. Pickersgill's yard the whole of the berths are empty. Messrs. R. Thompson & Sons have a vessel nearly ready for launching, and the framing of another has been commenced. It is expected that operations will soon be commenced at the new yard, South Hylton, as the keel for a small vessel has been laid. Messrs. Blumer & Co. have one vessel on the stocks, and frame-turning for another is proceeding. The Strand Shipbuilding Co. have a vessel in frame, the further construction of which appears to be hindered through delays in the delivery of material. In other instances, also, it is understood, that considerable inconvenience is felt through the difficulty of getting necessary supplies of plates and angles. The Sunderland Shipbuilding Co. launched during the month a fine vessel ordered by W. Lund, Esq., for employment in the Australian trade, and so far as is known they have now only one small steamer to build. Messrs. S. P. Austin & Sons have a vessel in the framing stage, and have also a considerable amount of repair work in hand. The number of unemployed men connected with shipbuilding at this centre is very large, but present appearances favour the expectation that a change may take place shortly.

Engineering.—An improvement in the state of business is to be noted at the Southwick Engine Works, and the working staff has already been increased. There is some talk of night work being resumed at this establishment, and it is needless to say that such an arrangement would necessitate the employment of a further number of hands. At the Palmer's Hill Works, the condition of things is fairly satisfactory, the working staff being very little below the normal strength. A large oil-carrying steamer, built by Messrs. Craig, Taylor & Co., of Thornaby-on-Tees, is at the time of writing receiving her machinery at the works, and two locally-built steamers are expected at the quay in the course of a few days, to be fitted with engines, &c. The demand for Dickinson's patent crank shaft is well sustained, and the manufacture of this speciality constitutes an important item in the general work of the establishment. The North Eastern Engine Works are moderately well employed, but the outlook is improving, and it is hoped that an increase in the number of hands required to carry on the work will soon become necessary. The prospect at Messrs. Doxfords' establishment is also encouraging, and there is little doubt that in this case also, more employment for operatives will soon be provided. Messrs. John Lynn & Co., of the St. Luke's Engine Works, Pallion, have a number of steering gears in progress for vessels building on the Wear, and are also well supplied with

orders for steam winches. Having recently extended their works they are now in a position to maintain a largely increased output. Considerable improvement is to be noted at most of the forging establishments, and iron foundries are also better employed. Business at the Monkwearmouth Iron Works continues satisfactory, and at the local chain and anchor works there is a continuance of steady trade. Orders for Mills' patent boat lowering gear have been pretty numerous lately, and the works at Brewery Bank, Monkwearmouth, have been kept busy. The rope works of Messrs. Dawson & Usher, Hendon Road, are kept steadily going on orders for ships' rigging and other specialities.

The Hartlepools.—Shipbuilding at this centre continues comparatively brisk, repair contracts being still largely instrumental in keeping up the reputation of the port for steadiness of work. During the past few weeks, several vessels engined by Messrs. Richardson & Sons have had successful trial trips. On June 17th the s.s. *Beltisloe*, owned by Messrs. Bennett, of Grimsby, proceeded from Hartlepool, with a large company on board, for a trial of her machinery. This vessel has engines with cylinders 24 in., 38 in., 64 in. by 42 in. stroke, and two large single ended boilers working at 160 lbs. pressure. The trial proved in every way satisfactory, the owners expressing themselves as highly satisfied with the results obtained. On June 21st the s.s. *Sybil*, which is the first of three vessels which Messrs. Richardson are fitting with new triple-expansion engines for F. Gordon, Esq., of Newcastle, made a successful run between Hartlepool and the Tyne. This vessel has just completed her first voyage (since re-engining) and when compared with previous voyages with the old compound engines, the results are most gratifying, a speed of 8¼ knots having been obtained on a coal consumption of 9½ tons per day, the speed under the old conditions having been 8 knots with a daily coal consumption of 16 tons. The second vessel, namely the s.s. *Rimpha*, is now on her first voyage (since being tripled) having run her trial trip on the 11th inst. The third of these vessels, viz., the s.s. *Orpington*, is now receiving her machinery at Messrs. Richardson's sheerlegs, and will be ready for sea shortly. On July 18th the s.s. *Stolzenfels*, built by Sir Raylton Dixon & Co. for the Hansa line, Bremen, ran her official trial from the Tees to Blyth. This is the first of three vessels which the builders have on order for the same company, all of which are being engined by Messrs. Richardson & Sons. The cylinders are 24 in., 38 in. and 64 in. diameter, by 42 in. stroke, and the boilers, which are built to work at 160 lbs. steam pressure, are of large capacity. They are fitted with Morison's Suspension Furnaces, and are constructed to pass German Government requirements. A novel form of feed heater is fitted in this ship, consisting of an arrangement of tubes at the base of the funnel, through which the feed water is forced on its passage to the boilers. The outside surface of the tubes is in contact with the waste products of combustion, and by this means a very high temperature of feed water is obtained.

The arrangement of this heater, which is the invention of Mr. Wulff, under whose superintendence the ship and engines have been constructed, is extremely ingenious, and we understand that in the large number of steamers in which it is fitted, excellent results have been obtained. On the trial of this vessel (the s.s. *Stolzenfels*) the machinery worked most satisfactorily, a speed of 11 knots having been attained. Several orders have been booked by Messrs. Richardson lately, and although not going at their fullest capacity, a satisfactory amount of briskness exists throughout the various departments of the works. As will be seen from a notice on another page, the firm have undertaken the manufacture of Geddes' Protector Fire Door, which is a distinct improvement on any of the existing forms of door, and which is already commanding a large sale. We are pleased to be able to state that the unfortunate dispute with the moulders has been settled, the men having returned to work on the terms originally asked for by the firm. It goes without saying that it would have been much wiser on their part to have thrown in their lot with the other sections of workmen, who recognised at the beginning that no successful resistance could be offered to the claim for a reduction.

Stockton.—The shipbuilding yards at this centre are on the whole fairly busy, Messrs. Ropner & Sons' establishment being probably the best supplied with work. Among other orders recently secured by Messrs. Blair & Co. is one for the engines and boilers of a large cargo steamer about to be laid down in a Tyne yard. During the month of June the following steamers engined by the firm, have had their trial trips :—The s.s. *Carib Prince*, built by Messrs. Short Bros., of Sunderland, for James Knott, Esq., of Newcastle, having engines of 175 H.P., with cylinders 22 in., 36 in., 59 in., by 39 in. stroke. The s.s. *Boston City*, built by Messrs. John Blumer & Co., Sunderland, for Messrs. Charles Hill & Son, of Bristol, having engines of 220 H.P., with cylinders 23½ in., 39 in., 64 in., by 42 in. stroke. The engines for both these steamers are constructed to work at 160 lbs. pressure of steam, and on their trials gave the fullest satisfaction to all interested. The work of the Stockton Malleable Iron and Steel Co. are just now in full operation, orders for shipbuilding and boiler-making material being plentiful.

Middlesbro'.—Last month we indicated that Messrs. Raylton, Dixon & Co. were building two large steamers for the Hansa Co., Bremen. This announcement was correct, but we are glad to be able to amend the information by the statement that the firm have in all, three vessels in hand for the company named, one of which, the s.s. *Stolzenfels*, was launched towards the end of June, and is now nearly ready for sea. The firm have other work on hand, and are on the whole much better off in the matter of prospective business than a good many of their competitors. The other shipbuilding firms at this centre are moderately well employed.

Darlington.—At the works of the Darlington Forge Co. there are several contracts of importance in hand, and the business prospect for the remainder of the year is satisfactory.

NORTH-WEST OF ENGLAND.

(*From our own Correspondent.*)

Barrow-in-Furness.—There is no improvement to note this month in the shipbuilding industry of Barrow. No new orders for new work have been booked, and very few contracts are offering. The demands for new tonnage in fact is less than ever, and the position is made all the more severe by the fact that such a large number of vessels are lying up idle. The shipping which is employed is only receiving a low rate of freight, and only the most modern and economical class of steamer is able to pay its way. Gradually the old type of vessel fitted with compound engines only is becoming obsolete, and it is fast becoming a question whether this shipping shall be broken up altogether or be fitted with modern engines. Doubtless much of the idle shipping now lying up would be treated in either one way or the other if there was any chance of trade improving, but there can be no question that in all cases where the hull of the vessels is far worn and not worth new engines it would be expedient and economical to break it up, and on the other hand where new engines are desirable to make old shipping useful and profitable, providing the hulls are sound, it would be economical to have the engines converted at the present time when the work can be done cheaply. The opinion is gaining ground that in the early future shipbuilders will get many repair orders of this class, and to some extent it will doubtless lead to fewer orders for new ships. But there are a few orders in the market, and although prices are so low that builders cannot see any margin of profit, it is probable that a few new contracts will be placed during August. There is certainly a necessity for new orders as the yards are becoming very bare, only one vessel being on the stocks at the yard of the Naval Construction and Armaments Co., being the last of three steamers ordered by the British and African Steam Navigation Co. During the month the Barrow Co. launched the s.s. *Bathurst* for the British and African Co., and the s.s. *Accra*, the first of the three sister-ships left Barrow on her trial trip to Liverpool, which passed off very satisfactorily. The business in repairs is pretty active at Barrow. The Naval Construction and Armament Co. have repair jobs in hand to two Clan Line steamers, to the s.s. *Cuban* and the s.s. *Barbadian*, while Messrs. Westray, Copeland & Co. are at work with repairs and new engines and boilers to the s.s. *Liverpool*. An application has been made to the High Court for the winding up of Messrs. Westray, Copeland & Co., Limited, owing to the financial embarrassment reported in THE MARINE ENGINEER last month. It is probable the concern will be transferred to a new company, but the prospects of trade in the engineering, ironfounding and boiler-making business are not good, and it is evident even if a new company took over the works, orders would have to be sought from outside the district.

West Cumberland.—There is very little business doing in the shipbuilding trade at Workington and Maryport, but the small yards there are kept steadily going on a small class of work. A

Whitehaven the yard is still closed, and no efforts are being made a present to resuscitate this branch of industry at Whitehaven.

Shipbuilding Material.—There is no local demand for steel shipbuilding material, and the mills are idle both in the plate and angle departments. There is, however, a good trade doing at the Barrow Steel Works in heavy steel castings for shipbuilding and other purposes, for Belfast and other firms, and the activity in this department is likely to be maintained during the year.

THE MERSEY.

(From our own Correspondent.)

THE condition of the marine engineering and shipbuilding industries throughout this district remains most unsatisfactory; not only is there a continued absence of any indication of improvement, but the outlook, if anything, becomes still more discouraging. The principal firms in this district are getting no new work whatever, so far as marine engine building is concerned, the only orders that are being given out being for occasional repairs and reconstruction, and these are very limited either in number or weight. One of the most important orders in this direction has been the refitting of Mr. Gordon Bennett's yacht, the *Namouna*, to which Messrs. Fawcett, Preston, & Co., Limited, of Liverpool, have been supplying new boilers and engines with forced draught to develop 1,500 H.P., as compared with about 800 H.P. in the previous engine; but this work is now practically completed, and the firm have no other work of importance in prospect as regards marine engineering; they are, however, very busy on special machinery for sugar plantation work. So far as shipbuilding is concerned, the outlook could scarcely be worse. The principal yards on the Liverpool side of the Mersey for months past have had practically nothing in hand except an occasional repair job, and the yards are almost closed. On the Birkenhead side Messrs. Laird Bros. are still kept fairly busy on Government work for home and abroad, but all the really big work is rapidly approaching completion, and there is little or nothing new coming forward to take its place. The large battleship, the *Royal Oak*, is now well on towards completion, and in a couple of months will be ready to send out. The steam yacht for Mr. Vanderbilt has now been completed, very satisfactory preliminary trials having already been made, and during the present month she will go through her final official trials. Taking shipbuilding all through on the Mersey, there are very few enquiries of any moment whatever stirring, and so far as any actual prospect of new work is concerned this is extremely small.

With regard to the condition of the engineering trades generally the position remains without any very material change. The reports issued by the various trades-union organizations show that the number of unemployed members on their books has varied very little during the last two or three months, whilst the reports received from the different districts as to the condition of trade, show that it too remains only indifferent generally. In the Annual Report of the Iron Trades' Employers' Association, which was presented at their meeting last week, the condition of trade in the engineering industries generally is summed up as having been unsatisfactory, taking it all through, during the past twelve months. Firms manufacturing specialities had been fairly well employed, but the reports sent in from the various districts connected with the Association show trade as generally quiet and falling off; whilst the Trades' Union Reports which had been received showed a considerable increase in the number of unemployed members during the twelve months. There had not been much to disturb relations between employers and employed, but reductions in wages had been the order of the day.

Referring to other matters the annual report of the Iron Trades' Employers' Association, adds that there has been a good deal of discussion on the question of reduction of hours, with regard to which a wide difference of opinion exists; evidently a uniform day's work was not acceptable or applicable to all trades. Three or four large firms had, on certain conditions, granted their men a concession to 48 hours per week. This had, however, been done entirely on their own responsibility without reference to other employers throughout the country, or even in their own districts. The trade societies had done their utmost to restrict their members from working overtime, but owing to the state of trade, and the small amount of overtime required, is restriction had done little to disturb relations with employers. Lengthy negotiations had taken place between the Federation of shipbuilders, engineers, and boiler-makers, and Mr. Knight, the General Secretary of the Boiler-makers' and Shipbuilders' Society, on the question of a restriction in the number and general employment of apprentices in shipyards and boiler shops, which had resulted in a provisional agreement. The final terms of settlement would, when ratified, be made known.

Machine tool-makers throughout this district continue only moderately employed from hand to mouth, very few of them having work of any moment ahead. The locomotive building trade continues in an extremely depressed condition, and most of the firms are very short of orders. Boiler-makers are fairly off for work, but generally there is a decided falling off in the weight of new orders coming forward. Heavy stationary engine builders continue moderately employed; some of the principal firms being pretty full of work, and this branch of trade is, perhaps, better than any other in the district.

In the iron trade the spurt of buying, which was a noticeable feature at the close of last month, has very quickly fallen off, but the slight increase in prices which makers were able to put on, owing to the increased weight of orders coming forward, has generally been well maintained. For local brands of pig-iron quotations have remained unchanged, but these all along have been substantially above those for district brands offering here. For Lancashire iron at the works, quotations average 40s. for forge to 41s. for foundry, less 2½; for district brands coming into this market prices are now generally quoted on the net basis, and for delivery here, Lincolnshire now averages 39s. 6d. for forge to 41s. and 41s. 6d. for foundry, net cash; Derbyshire 41s. for forge, to 44s. 6d., and 45s. for foundry, net. Outside brands are showing considerable firmness, with rather a hardening tendency; good foundry Middlesbrough not being obtainable under 43s. 10d., net cash, delivered here, whilst for Scotch iron Eglinton has got up to 44s. 6d. and Glengarnock is quoted at 46s., net, prompt cash, delivered at the Lancashire ports.

In manufactured iron there has been a little more doing, and makers have stiffened up somewhat in their prices, Lancashire bars not now being quoted under £5 10s., with Staffordshire qualities averaging £5 12s. 6d.; Lancashire sheets, £7 2s. 6d. to £7 5s.; and Staffordshire, £7 10s.; but hoops remain unchanged at £5 17s. 6d. for random, and £6 2s. 6d. for special cut lengths, delivered in this district.

In the steel trade business continues only slow, and any appreciably better prices have been very difficult to obtain. For hematites makers' quotations are about 53s. 6d. to 54s., less 2½ for small parcels of good foundry qualities, delivered to consumers in this district, but for quantities under this figure would be taken. Local makers of steel billets still quote £4 4s., net cash, delivered, but are not doing very much at these figures. In steel plates there has been a tendency to harden up in the best boiler-making qualities, and the leading makers have been holding out for £6 7s. 6d., but there has been very little business done at much over £6 5s., delivered here.

In the metal market there has been a fair amount of business doing, and list rates have been firm at fully late quotations. Delivered in this district they remain about as under:—Solid drawn brass boiler tubes, 5½d.; solid drawn brass surface condenser tubes, 7d.; solid drawn copper tubes, 7¼d.; brazed copper gas and steam tube, 7d.; brazed brass gas tube, 6¼d.; brass wire, 5¼d.; copper wire, 6½d.; rolled brass, 5¼d.; copper sheets, 8¼d.; yellow metal bolts, 5½d.; yellow metal condenser plates, 5½d.; cast composition sheathing nails and spikes, 5¾d.; cast red metal sheathing nails and spikes, 7½d.; wrought copper rivets, 8¼d.; wrought copper boat nails, 8½d. to 9¼d.; wrought copper tacks, 11¼d. to 1s. 2¼d.; cut copper nails, 8d. to 9½d. per lb.; and copper bolts, £61 per ton.

Business in the timber trade continues generally quiet, the demand being inactive, and values remain about stationary, with stocks ample for requirements. Of East India teak there has been a moderate import and consumption with prices fairly well maintained, and the stock is in fair compass. There have been no arrivals of greenheart here, whilst on the other hand there has been a good consumption which has helped to reduce the stock; this, however, is still too heavy whilst prices are lower, with prospects of further decline.

The chief matter of importance just now in the district is of course the strike in the coal trade against any reduction in wages, the offers by the coal owners to refer the matter to arbitration having been rejected by the representatives of the

Miners' Federation. As soon as it became evident that the stoppage of the collieries was inevitable there was naturally a very considerably increased pressure of demand for all descriptions of fuel, especially those required for iron making, forge, steam, and general manufacturing purposes, and consumers anxious to cover themselves with extra supplies have been freely purchasing the lower qualities of round coal at advanced prices. Should the strike be of a protracted character, and prices advance to any very considerable extent, it is, however, not unlikely that a number of the iron works in this district will for the time being cease operations, as in the present unsatisfactory condition of trade they are not likely to lose more by stopping than by going on at unremunerative prices, and in any case so serious and general a strike in the coal trade cannot but have a disastrous effect upon all industries dependent upon fuel supplies. In the present exceptional state of trade it would be difficult to quote anything like definite prices, as these are largely governed by special circumstances, but upon all descriptions of fuel for steam, forge, and manufacturing purposes there has been a considerable advance, ranging from 2s. up to 4s. per ton. Steam and forge coals have been readily fetching 9s. 6d. up to 10s., and engine classes of fuel, 8s. 6d. to 9s. per ton at the pit mouth, whilst through and through coal has been largely taken in place of burgy and slack at about 9s. to 9s. 6d. per ton.

In the shipping trade there was at first rather a disposition to be dubious about the threatened strike and buyers held back from placing out orders except at the very minimum rates, but during the fortnight prior to the termination of the notices considerably increased enquiry came forward, whilst colliery proprietors were indisposed to send much coal to the ports, and considerably advanced prices had to be paid to secure supplies, 10s. to 10s. 6d. per ton being very general figures for ordinary steam coals delivered at the Garston Docks, or the High Level, Liverpool, and in some instances offers at considerably over these figures have been declined.

The Shipwrights' Company.—At a meeting of the Court of Shipwrights' Co., Mr. W. H. White, C.B., Director of Naval Construction, Warden of the company, said that arrangements had been made by the company to assist classes in naval architecture, and to give prizes to students of Glasgow University, Newcastle College of Science, the evening classes of the Science and Art Department throughout the kingdom, and the evening classes at Blackwall. In the absence of Lord Brassey, the Master, Mr. G. E. Wood presented the prizes gained during the past year by students of the Company's classes at the Thames Iron-works.

Loading Facilities for Iron Ore at Lulea.—In a recent report to the Foreign Office, Mr. M. S. Constable, her Majesty's Consul at Stockholm, states that important improvements have been effected in the arrangements for shipping iron ore at the port of Lulea. Last year it was not possible to lift and load more than 2,000 tons daily at the quay, partly owing to the defective mechanism of the shoots. The large steamships were especially inconvenienced. New shoots have now been constructed, and much time will also be saved in the loading of vessels by means of an hydraulic lift for lowering the empty trucks from the elevated railway. It is expected that it will now be possible to load as much as 5,000 tons of ore per diem.

Queenstown v. Southampton Mail Route to New York.—Mr. Chamberlayne, in the House of Commons, asked the Postmaster-General which was the more expeditious route for the delivery of mails between London and New York, via Queenstown or via Southampton, if the steamers were of equal speed. Mr. A. Morley answered, with steamers of the same speed there would be a slight advantage in favour of the Queenstown route; but the advantage diminished as the speed of the steamer increases. Allowing 17 hours for the conveyance of the mails from the General Post Office, London, to the packet at Queenstown, and four hours from the General Post Office, London, to the packet at Southampton, the advantage in favour of Queenstown would be as follows: steaming 16 knots, 5 h. 41 min.; steaming 18 knots, 3 h. 50 min.; steaming 20 knots, 2 h. 21 min.; steaming 22 knots, 1 h. 9 min.; steaming 23 knots, 36 min.

A New French Cruiser.—A new cruiser, the largest in the French Navy, is ordered to be built at La Seyne. She will be named the *D'Entrecasteaux*, being intended for service as flagship in distant seas, and will be sheathed and coppered. Her displacement will be 8,114 tons; her length at the water-line, 393 ft. 6 in.; her extreme breadth, 58 ft. 5 in.; and her extreme draught, 29 ft. 6 in. She will have two vertical triple-expansion engines, with five cylindrical boilers, developing in all 14,000 H.P., and giving a speed of 19 knots. The normal bunker capacity is to be 650 tons; but it will be possible to carry 1,000 tons of coal. The protection consists of a 3·9 in steel deck, with above it a great number of cellular compartments for coal and stores, the whole being covered by another steel deck three-quarters of an inch thick. The whole of the hull below the protection is occupied by the machinery, boilers, bunkers, and magazines. Each of the heavier guns has its own separate ammunition hoist. These, and also all the auxiliary machinery, steering gear, internal lighting, loading and training engines, &c., will be electrical. The armament will consist of two 9·4 in. guns of 40 calibres; 12 5·5 in. quick-fire, 12 1·85 in. quick-fire, and four 1·45 in. quick-fire, with two submerged and five above-water torpedo-tubes, two of the latter being in the bows. Each of the 9.4 in. guns will occupy a closed turret covered with 9·8 in. steel. Four of the 5·5 in. quick-fire guns will be on the spar-deck behind 2·8 in. hardened steel shields, and the remaining eight upon the main deck in sponsons behind similar shields. She will cost £620,000, and will be somewhat larger than our new first-class cruisers of the *Edgar* and *Crescent* classes, but a little smaller than those of the *Blenheim* type. She will also be exceeded in size by the Russian cruiser *Rurik*, but she will be a knot faster. In size she will most nearly approximate to the new American cruiser *New York*.

Deep Water Harbour for Dover.—The Prince of Wales visited Dover on Thursday afternoon, July 20th, and laid the foundation stone of the new deep-water harbour works, the construction of which has been undertaken by the Local Harbour Board. The undertaking has been designed not only to meet the requirements of the rapidly growing cross-traffic between England and the Continent, but also in the hope that ocean trade may be encouraged. At any rate, the scheme inaugurated by the Prince of Wales will have the effect of providing Dover with a great accession of improved and additional harbour accommodation, the works being intended to furnish a sheltered area of 53 acres, at an estimated cost of about £600,000, a sum which in all probability will be considerably exceeded. The object which the harbour board appear to have kept in view is that of providing a deep-water harbour affording as large and sheltered an area as their resources allow, and working within this limit plans have been drawn which allow for the development of local commerce, giving ample accommodation for the continual growth of the Channel traffic, and affording sufficient depth of water for large ocean-going steamers to put in at all states of the tide. For the purposes of the modern shipping trade, depth is of greater importance than lateral space. Just within the harbour mouth there will be a depth of about 60 ft. at high water and 40 ft. at low tide. The new work begins a little eastward of the well-known clock-tower, which has been removed a short distance westward to make a clear way to the approach road. The second part of the undertaking will be the construction of a water station for the convenience of the Continental steam packet service, and the third and last part of the work will be the extension of the Admiralty Pier, the proposal being to add 580 ft. in an easterly direction to the end of the present structure. Under their Act of Parliament the Harbour Board levy a poll-tax of 1s. on all passengers crossing the Channel. This has been in force now for twelve months, and is estimated to produce about £16,000 per annum, with which sum it is proposed to construct the harbour. The harbour now being made will not in any way interfere with the construction of a large national harbour which some succeeding Government may one day have the courage to undertake. The entire harbour works will, it is expected, occupy ten years in construction. The town was gaily decorated on Thursday, and the day was observed as a public holiday, but the pleasure of sightseers was considerably marred by the inclement weather. The function of laying the stone was followed by the presentation of an address by the Corporation, in reply to which the Prince of Wales said that the wisdom of his ancestors caused them to regard Dover as a port of great importance for the safety and welfare of the country, and he was glad to know that endeavours had been made by successive Lords Warden to induce the Government to construct a national harbour at Dover. A luncheon followed, at which the health of the Prince was proposed by Lord Dufferin, who said that extended intercourse with our Continental neighbours, such as the new harbour would promote, was the best way of securing the continuance of friendly relations with them. The Prince, in acknowledging the toast, expressed the hope that this result would be attained.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Romney—On June 27th there was launched by Messrs Joseph L. Thompson & Sons, at Sunderland, a steel screw steamer, built to the order of Mr. Frederic Bolton, of London, of the following dimensions :—Length, 328 ft.; breadth, 42 ft.; depth, moulded, 26 ft. 10 in. The vessel is of the spar deck type, and has been built under Lloyd's special survey for the 100 A1 class. The engines by Mr. John Dickinson, of Palmer's Hill, are of the triple-expansion type, having cylinders 23½ in., 38 in., and 62 in. diameter respectively, with a stroke of 42 in. The vessel was named *Romney*.

Batoum.—On June 29th there was launched by Mr. James Laing, on the Wear, an oil bulk tank steamer, built to the order of Messrs. Alfred Suart, of London, and J. S. Barwick, of Sunderland. The dimensions of the vessel are: — Length, 345 ft.; extreme breadth, 44 ft. 9 in.; and depth, 33 ft. 3 in.; while her carrying capacity will be 5,000 tons. The engines will be supplied by Mr. John Dickinson, Sunderland. The boat was named the *Batoum*.

Scarsdale.—On Thursday afternoon, June 29th, Messrs. Richardson, Duck & Co. launched from their yard a steel screw steamer of the following dimensions :—Length over all, 307 ft.; beam extreme, 40 ft.; depth moulded, 21 ft. 8½ in.; tonnage gross, about 2,600 tons. This vessel, which has been built to the order of Messrs. Lucas & Co. for the Scarsdale Steamship Co., Limited, of Bristol, is classed 100 A1 on Lloyd's Register, and has been built under special survey. She has a half poop containing accommodation for captain and officers, a long raised quarter-deck, and a part awning-deck, engineers being berthed in a house at after end of casing, and crew alongside forehatch. A cellular double bottom is fitted throughout. Vessel will be schooner rigged, and her equipment includes four steam winches, steam windlass, by Emerson, Walker & Co., stockless anchors, steam steering gear, large donkey boiler, and all modern appliances for facilitating loading, discharging, and manœuvring. Her engines, by Messrs. Blair & Co., have cylinders 22 in., 36 in., and 59 in. by 39 in. stroke, steam being supplied by two single-ended boilers of 160 lbs. working pressure. As the vessel left the ways she was christened the *Scarsdale* by Miss Gillet, of Warminster, Wilts.

Pelotas.—On July 1st there was launched from the shipbuilding yard of Messrs. Edwards' Shipbuilding Co., Limited, Howden-on-Tyne, a steel screw steamer named *Pelotas*, built for the Hamburg-South American Steamship Co., of Hamburg. The following are the dimensions of hull :—Length, 280 ft.; breadth, 31 ft.; depth moulded spar deck, 26 ft. The bows are strengthened to resist ice. The vessel is arranged to carry 500 emigrants. The engines and boilers are being built by Messrs. George Clark, Limited, of Sunderland, and are of the triple-expansion type, having cylinders 21 in., 34 in., and 56 in. by 39 in. stroke, steam being supplied by two steel boilers at a working pressure of 160 lbs. per square inch.

Dragon. — On July 4th Messrs. Anderson & Laverick launched on the Tyne a steamer built to the order of Mr. Joseph Constant, of London. Her dimensions are :—Length, 125 ft.; breadth, 24 ft.; depth, moulded, 10 ft. 2 in. She will carry 400 tons, and be fitted with compound surface-condensing engines by Messrs. Hedley & Boyd, of North Shields. The vessel was christened the *Dragon*.

Screw Tug.—On July 4th there was launched by Messrs. Scarr, at Beverley, the hull of a screw tug 67 ft. long, for Messrs. Richardson, of Grimsby. She will be fitted with compound surface-condensing engines having cylinders of 14 in. and 28 in., by 18 in. stroke, by Messrs Hedley & Boyd, of North Shields.

Dee and Don.—On July 5th, Earle's Shipbuilding Co. launched at Hull the steam trawlers *Dee* and *Don*, which have been constructed by them for Messrs. Morris & Jeffs, of Grimsby. They are 97 ft. long, 20 ft. 6 in. beam, and 11 ft. depth of hold; built of iron, to Lloyd's 100 A class. Fitted with patent trawler windlass by Emerson, Walker & Co. They will be fitted with three crank triple-compound engines, having cylinders 11 in., 17 in., and 30 in. diameter, by 21 in. stroke.

Lutece.—On July 12th there was launched by Messrs. S. P. Austin & Son, at Sunderland, a steel screw steamer of the following dimensions :—Length 247 ft. breadth, 35 ft 3 in.; depth, 18 ft. moulded; gross tonnage about 1,380 tons. The vessel has been constructed under special survey at Lloyd's, and will be fitted with triple-expansion machinery by Messrs. George Clark, Limited, of Southwick. She was named *Lutece*.

Cayo Romano.—On July 15th there was launched from the shipbuilding yard of Messrs. John Readhead & Sons, West Dock, South Shields, a new screw steamer named the *Cayo Romano*. This vessel is of the spar-decked type, and is of the following dimensions :—Length, 315 ft.; breadth, 41 ft.; depth, moulded, 26 ft. 10 in.; and is classed 100 A 1 at Lloyd's. The steamer is provided with triple-expansion engines, also built by Messrs. Readhead, with cylinders 24 in., 40 in., and 65 in., by 42 in. stroke, and two steel boilers, tested to 160 lbs. working pressure. The *Cayo Romano* has been built to the order of Messrs. Ernest Bigland & Co., London, and is intended for the American and West Indian trades.

Mexican Prince.—On July 13th there was successfully launched from the West Yard of the firm of Messrs. C. S. Swan & Hunter, shipbuilders, Wallsend, a large and beautifully modelled steel screw steamer, built specially for the carrying of petroleum in bulk, and adapted as well for general cargo. The vessel, which is owned by Mr. James Knott, is the latest augmentation to the Prince line of steamers. The new ship measures 339 ft. in length, 41 ft. in breadth, with a moulded depth of 27 ft. 6 in. She is built on the spar-deck type, with poop, bridge, and forecastle, and is rigged as a three masted fore and aft schooner. The vessel is fitted with eleven oil-tight bulkheads, and an oil-tight centre bulkhead, extending through the tanks, special arrangements having been made, and elaborate machinery introduced to enable the owners to carry general cargo in lieu of oil if required. When loaded with oil the danger hitherto incurred by the inflammable nature of the cargo has been minimised by a complete equipment of revolving fans, by which the accumulated gas is pumped from the tanks. The craft has been constructed under special survey, and will take the highest class at Lloyd's and the Bureau Veritas. Her engines have been built by Messrs. Blair & Co., Stockton-on-Tees, the dimensions of her cylinders being 23 in., 38 in., and 62½ in., with a stroke of 42 in. On leaving the ways the craft was named the *Mexican Prince* by Miss Ethel Trail.

Olympia.—On July 13th there was launched by Messrs. W. Harkess & Son, at Middlesbrough, a steel screw steamer, which has been built to the order of a Spanish firm for their line of Spanish coasting steamers. The dimensions are as follows: Length, 168 ft. 6 in.; breadth, 24 ft. 6 in.; depth, 12 ft. 9 in., with a deadweight carrying capacity of 550 tons. She will be fitted with tri-compound engines by Messrs. Westgarth, English & Co.

Warrigal.—On July 13th there was launched from the yard of the Sunderland Shipbuilding Co., Limited, a steel screw steamer built to the order of William Lund, Esq., of London, being the third vessel constructed by the above firm for this gentleman. The dimensions of the steamer are as follows:—Length between perpendiculars, 400 ft.; breadth of beam, 48 ft.; depth moulded, 30 ft.; classed 100 A1 Lloyd's, on the three deck grade. The accommodation for first-class passengers is placed in a large full poop aft, which is entered from the main deck, also through a smoke-house which is fitted out in light oak and plane tree, the saloon itself is entirely panelled in different shades of solid oak with carved oak caps and mouldings relieved with gold. Accommodation is provided for 16 first class passengers in commodious state-rooms. The captain's room is also placed aft. Accommodation for officers, engineers, and petty officers is placed under a long bridge, two large galleys are also built, one for passengers and the other for emigrants and crew. There is a long topgallant forecastle under which accommodation is fitted for the seamen and fireman, bath room is also provided for their use. Quadruple compound engines will be supplied by Messrs. Wigham, Richardson & Co., Newcastle-on-Tyne, having cylinders, 25½ in., 36½ in., 52 in., and 78 in., by 54 in. stroke, with three large double-ended boilers working at a pressure of 200 lbs. per square inch, which will give the vessel an average speed of 13 knots loaded. The steamer has been specially designed by the owner's line running between London and Australia. Board of Trade passenger certificate is supplied, and special attention has been paid in regard to ventilation, etc., in order to carry large numbers of emigrants. The vessel will also be on the Admiralty list for the conveyance of troops. During construction she has been superintended by Captain Ilberry, of London, who

will command the vessel on her first voyage. The engines have been inspected during construction by Mr. A. Thomson, of London. Upon leaving the ways she was gracefully named *Warrigal* by Mrs. Lund, wife of the owner, and then taken direct to the Tyne for shipment of machinery.

Fijian.—On July 14th there was launched from the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesbrough, a finely modelled steam trawler named the *Fijian* for Grimsby account, which is the sixth vessel built for the same owners by these builders. The principal dimensions are:—Length, 107 ft. 8 in.; beam, 20 ft. 5 in.; depth, moulded, 11 ft. 8 in.; and fitted with engines by the North Eastern Marine Engineering Co., Limited, of Sunderland, the cylinders being 11 in., 17 in. and 28 in. by 21 in. stroke. The vessel is fitted with the latest appliances for her special trade. Fitted with patent trawler windlass by Emerson, Walker & Co. Is considerably stronger than Lloyd's requirements for their highest class, and double rivetted throughout.

Ariadne Alexandra.—On July 15th Messrs. Wm. Gray & Co., Limited, launched the handsome steel-screw steamer *Ariadne Alexandra*, of the following dimensions, viz.:—Length, over all, 283 ft.; breadth, 38 ft.; depth, 20 ft. 3 in., and has been built to the order of the Ariadne Steamship Co., Limited, London, to take Lloyd's highest class. The deck erections consist of poop, raised quarter-deck, long bridge and topgallant forecastle. A handsome saloon and accommodation for officers and a few passengers will be fitted up in the poop, and comfortable quarters for the crew in the fore part of the bridge. The hull is built with web frames, and a cellular double-bottom is fitted throughout. A large donkey boiler, four steam winches, steam steering gear amidships, screw gear aft, patent direct steam windlass by Emerson Walker Co. Boats on beams overhead, and all modern appliances will be fitted. The engines are of the triple-expansion type, of 800 H.P., working on three cranks, and are supplied by the Central Marine Engine Works of William Gray & Co., Limited. The cylinders are 20 in., 31½ in., and 53 in. diameter, with a piston stroke of 36 in. The boilers built of steel, are of large size, and will give an ample supply of steam at a working pressure of 160 per square inch. The vessel has been superintended during construction by Captain T. Pyman on behalf of the owners. The ceremony of naming the ship *Ariadne Alexandra* was gracefully performed by Mrs. Rodocanachie, of London.

Baracaldo.—On July 15th Messrs. William Gray & Co., Limited, launched the *Baracaldo*, which has been built to the order of Ramon de la Sota, of Bilbao. She is a fine, handy steamer, taking Lloyd's highest class, and her dimensions are:—Length, overall, 239 ft.; breadth, 30 ft.; depth, 16 ft. 9½ in. She has a poop, raised quarter-deck, bridge, and topgallant forecastle, is built with web frames, and double bottom under each hold, and will be thoroughly equipped with donkey boiler, steam steering gear, four steam winches, patent direct steam windlass by Emerson, Walker & Co., &c., for general trading. She will have triple-expansion engines made at the Central Marine Engine Works of Messrs. William Gray & Co., Limited, having cylinders 16½ in., 26 in., and 44 in., with a piston stroke of 33 in., and a large steel boiler to work at a pressure of 160 lbs. per square inch. The ceremony of naming the ship *Baracaldo* was gracefully performed by Mrs. G. H. Baines, of West Hartlepool.

Bathurst.—On Saturday, July 15th, the Naval Construction and Armaments Co. launched from their shipbuilding yard at Barrow-in-Furness the s.s. *Bathurst*, built to the order of the British and African Steam Navigation Co., Limited, of Glasgow. This is the second of three vessels on order for this company. The christening ceremony was gracefully performed by Mrs. George Hutchinson, of The Grove, Upholland. The *Bathurst* is 336 ft. long, 39 ft. 3 in. beam, and 25 ft. moulded depth and is built to the highest class at Lloyd's. She is constructed under the three deck rule and cellular double bottom principle, water ballast being carried nearly the whole length, and has two complete decks and a poop bridge and forecastle, the upper deck being sheathed with wood. She is sub-divided into seven water-tight compartments. When finished she will be rigged as a fore and aft schooner, the masts being built of steel, and will be propelled by powerful inverted direct-acting triple-expansion engines of the most improved type, the cylinders being 23 in., 38 in., and 63 in. diameter, by 42 in. stroke, capable of developing 1,600 H.P., which will drive the ship at 11½ knots, loaded. The steam will be supplied by two large steel single-ended boilers, constructed for a working pressure of 180 lbs. per square inch. The vessel is designed as a first-class passenger steamer, and fitted with all the latest improvements suitable for the African trade. On the upper deck amidships, under the bridge, there is accommodation for 48 first-class passengers, including dining saloon, ladies' cabin, and pantry; also the engineers' room, galley stores, bath-room, w.c.'s, &c., &c. On the bridge deck, which forms a very fine promenade, there are the first-class smoke-room and ladies' drawing-room. The second-class passengers, 14 in number, are accommodated under the poop, as are also ship's officers, stewards, &c. The crew's quarters are fitted up under forecastle deck. The arrangements for the accommodation of passengers are of the most approved style, the saloon being very spacious and particularly well lighted and ventilated. A complete system of electric lights will be fitted in passengers', officers', and crew's spaces, also cargo lights. For loading and discharging cargo special arrangements have been made, there being two powerful steam cranes in addition to four winches, steam for these being supplied by a donkey boiler placed in the side casing.

James Tennant.—On July 15th there was launched from the yard of Messrs. Wood, Skinner, & Co., at Bill Quay-on-Tyne, a steel screw steamer, built to the order of Messrs. T. Thompson & Son, Newcastle. The vessel is of the raised quarter-deck type, and has been specially designed for the coasting trade. The engines have been constructed by the North-Eastern Marine Engineering Co., Limited, Wallsend, to whose works the vessel was towed immediately after the launch. The ship and engines have been built under Lloyd's special survey for 100 A1 classification. The vessel on leaving the ways was named *James Tennant*, the ceremony being performed by Miss Kent, of Heaton.

Linden.—On July 15th there was launched from the ship-building yard of Messrs. William Dobson & Co., Low Walker, a steel screw steamer, which has been built to the order of Messrs. J. G. Charlton & Co., of Newcastle. The vessel is 163 ft. long, 23 ft. beam, and 11 ft. 8 in. depth, moulded. She is fitted with a partial double bottom for water ballast, and all the latest appliances for the rapid loading and discharging of cargo in the trade for which she is intended. The machinery for the vessel is of the triple-expansion type, having cylinders 13 in., 20 in., and 33 in. by 24 in. stroke, with ample boiler power. It is being made by the North-Eastern Marine Engineering Co., Limited. On leaving the ways the vessel was named the *Linden*, by Miss Charlton, and immediately afterwards was taken to the engineers' works at Wallsend to receive her machinery.

Zaire.—On Saturday afternoon, July 15th, there was launched from the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesbrough, a very fine steel-screw passenger and mail steamer which has been built to the order of Messrs. Empreza Nacional de Navagacao, of Lisbon, under the superintendence of Captain T. C. Laws, of Liverpool. The vessel is built to Lloyd's spar-deck rule, and will take their highest class, her principal dimensions being:—Length, 350 ft. 6 in.; beam, 42 ft. 2 in.; depth, moulded, 28 ft. 9 in. The spar-deck is of steel, sheathed with teak, and main deck of steel sheathed with yellow pine, water ballast is fitted in cellular double-bottom, and in deep tank aft. Accommodation for about 250 passengers will be fitted up on the main deck, together with rooms for mails, plate, linen, luggage, &c. The vessel will be lighted throughout with electricity. Engines by Messrs. T. Richardson & Sons, of Hartlepool, will be supplied, and a high sea speed will be maintained. As the steamer was leaving the ways she was named the *Zaire* by Mrs. Laws, the wife of T. C. Laws, Esq., of Liverpool, the superintendent of the company.

Rhone.—On July 20th Messrs. Cookrane & Copper launched at Grovehill, Beverley, a steam trawler, built for Mr. G. F. Slight, Weelsby Hall, Grimsby. The vessel was named the *Rhone*. The *Rhone* is 87 ft. by 20 ft. by 10 ft. 8 in., and is fitted with 44 N.H.P. compound s.c. engines by Messrs. C. D. Holmes & Co., Hull.

Dart and Derwent.—On July 20th two additions were made to the fishing fleet of Messrs. Morris & Jeffs, jun., of Grimsby, by the launching of two iron steam trawlers from the yard of Earle's Co. at Hull. The vessels were named the *Dart* and *Derwent*.

Lachesis.—A steel screw steamer, the *Lachesis*, built to the order of the Port of London Sanitary Authority, has been launched by

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—ENGLISH.

Romney.—On June 27th there was launched by Messrs Joseph L. Thompson & Sons, at Sunderland, a steel screw steamer, built to the order of Mr. Frederic Bolton, of London, of the following dimensions:—Length, 328 ft.; breadth, 42 ft.; depth, moulded, 26 ft. 10 in. The vessel is of the spar deck type, and has been built under Lloyd's special survey for the 100 A1 class. The engines by Mr. John Dickinson, of Palmer's Hill, are of the triple-expansion type, having cylinders 23½ in., 38 in., and 62 in. diameter respectively, with a stroke of 42 in. The vessel was named *Romney*.

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Dragon. — On July 4th Messrs. Anderson & Laverick launched on the Tyne a steamer built to the order of Mr. Joseph Constant, of London. Her dimensions are:—Length, 125 ft.; breadth, 24 ft.; depth, moulded, 10 ft. 2 in. She will carry 400 tons, and be fitted with compound surface-condensing engines by Messrs. Hedley & Boyd, of North Shields. The vessel was christened the *Dragon*.

Screw Tug.—On July 4th there was launched by Messrs. Scarr, at Beverley, the hull of a screw tug 67 ft. long, for Messrs. Richardson, of Grimsby. She will be fitted with compound surface-condensing engines having cylinders of 14 in. and 28 in., by 18 in. stroke, by Messrs Hedley & Boyd, of North Shields.

Dee and Don.—On July 5th, Earle's Shipbuilding Co. launched at Hull the steam trawlers *Dee* and *Don*, which have been constructed by them for Messrs. Morris & Jeffs, of Grimsby. They are 97 ft. long, 20 ft. 6 in. beam, and 11 ft. depth of hold; built of iron, to Lloyd's 100 A class. Fitted with patent trawler windlass by Emerson, Walker & Co. They will be fitted with three crank triple-compound engines, having cylinders 11 in., 17 in., and 30 in. diameter, by 21 in. stroke.

Lutece.—On July 12th there was launched by Messrs. S. P. Austin & Son, at Sunderland, a steel screw steamer of the following dimensions:—Length 247 ft. breadth, 35 ft 3 in.; depth, 18 ft. moulded; gross tonnage about 1,380 tons. The vessel has been constructed under special survey at Lloyd's, and will be fitted with triple-expansion machinery by Messrs. George Clark, Limited, of Southwick. She was named *Lutece*.

Cayo Romano.—On July 15th there was launched from the shipbuilding yard of Messrs. John Readhead & Sons, West Dock, South Shields, a new screw steamer named the *Cayo Romano*. This vessel is of the spar-decked type, and is of the following dimensions:—Length, 315 ft.; breadth, 41 ft.; depth, moulded, 26 ft. 10 in.; and is classed 100 A 1 at Lloyd's. The steamer is provided with triple-expansion engines, also built by Messrs. Readhead, with cylinders 24 in., 40 in., and 65 in., by 42 in. stroke, and two steel boilers, tested to 160 lbs. working pressure. The *Cayo Romano* has been built to the order of Messrs. Ernest Bigland & Co., London, and is intended for the American and West Indian trades.

Mexican Prince.—On July 13th there was successfully launched from the West Yard of the firm of Messrs. C. S. Swan & Hunter, shipbuilders, Wallsend, a large and beautifully modelled steel screw steamer, built specially for the carrying of petroleum in bulk, and adapted as well for general cargo. The vessel, which is owned by Mr. James Knott, is the latest augmentation to the Prince line of steamers. The new ship measures 339 ft. in length, 41 ft. in breadth, with a moulded depth of 27 ft. 6 in. She is built on the spar-deck type, with poop, bridge, and forecastle, and is rigged as a three masted fore and aft schooner. The vessel is fitted with eleven oil-tight bulkheads, and an oil-tight centre bulkhead, extending through the tanks, special arrangements having been made, and elaborate machinery introduced to enable the owners to carry general cargo in lieu of oil if required. When loaded with oil the danger hitherto incurred by the inflammable nature of the cargo has been minimised by a complete equipment of revolving fans, by which the accumulated gas is pumped from the tanks. The craft has been constructed under special survey, and will take the highest class at Lloyd's and the Bureau Veritas. Her engines have been built by Messrs. Blair & Co., Stockton-on-Tees, the dimensions of her cylinders being 23 in., 38 in., and 62½ in., with a stroke of 42 in. On leaving the ways the craft was named the *Mexican Prince* by Miss Ethel Trail.

Olympia.—On July 13th there was launched by Messrs. W. Harkess & Son, at Middlesbrough, a steel screw steamer, which has been built to the order of a Spanish firm for their line of Spanish coasting steamers. The dimensions are as follows: Length, 168 ft. 6 in.; breadth, 24 ft. 6 in.; depth, 12 ft. 9 in., with a deadweight carrying capacity of 550 tons. She will be fitted with tri-compound engines by Messrs. Westgarth, English & Co.

Warrigal.—On July 13th there was launched from the yard of the Sunderland Shipbuilding Co., Limited, a steel screw steamer built to the order of William Lund, Esq., of London, being the third vessel constructed by the above firm for this gentleman. The dimensions of the steamer are as follows:—Length between perpendiculars, 400 ft.; breadth of beam, 48 ft.; depth moulded, 30 ft.; classed 100 A1 Lloyd's, on the three deck grade. The accommodation for first-class passengers is placed in a large full poop aft, which is entered from the main deck, also through a smoke-house which is fitted out in light oak and plane tree, the saloon itself is entirely panelled in different shades of solid oak with carved oak caps and mouldings relieved with gold. Accommodation is provided for 16 first class passengers in commodious state-rooms. The captain's room is also placed aft. Accommodation for officers, engineers, and petty officers is placed under a long bridge, two large galleys are also built, one for passengers and the other for emigrants and crew. There is a long topgallant forecastle under which accommodation is fitted for the seamen and fireman, bath room is also provided for their use. Quadruple compound engines will be supplied by Messrs. Wigham, Richardson & Co., Newcastle-on-Tyne, having cylinders, 25½ in., 36½ in., 52 in., and 78 in., by 54 in. stroke, with three large double-ended boilers working at a pressure of 200 lbs. per square inch, which will give the vessel an average speed of 13 knots loaded. The steamer has been specially designed by the owner's line running between London and Australia. Board of Trade passenger certificate is supplied, and special attention has been paid in regard to ventilation, etc., in order to carry large numbers of emigrants. The vessel will also be on the Admiralty list for the conveyance of troops. During construction she has been superintended by Captain Ilberry, of London, who

will command the vessel on her first voyage. The engines have been inspected during construction by Mr. A. Thomson, of London. Upon leaving the ways she was gracefully named *Warrigal* by Mrs. Lund, wife of the owner, and then taken direct to the Tyne for shipment of machinery.

Fijian.—On July 14th there was launched from the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesbrough, a finely modelled steam trawler named the *Fijian* for Grimsby account, which is the sixth vessel built for the same owners by these builders. The principal dimensions are:—Length, 107 ft. 8 in.; beam, 20 ft. 5 in.; depth, moulded, 11 ft. 8 in.; and fitted with engines by the North Eastern Marine Engineering Co., Limited, of Sunderland, the cylinders being 11 in., 17 in. and 28 in. by 21 in. stroke. The vessel is fitted with the latest appliances for her special trade. Fitted with patent trawler windlass by Emerson, Walker & Co. Is considerably stronger than Lloyd's requirements for their highest class, and double rivetted throughout.

Ariadne Alexandra.—On July 15th Messrs. Wm. Gray & Co., Limited, launched the handsome steel-screw steamer *Ariadne Alexandra*, of the following dimensions, viz.:—Length, over all, 283 ft.; breadth, 38 ft.; depth, 20 ft. 3in., and has been built to the order of the Ariadne Steamship Co., Limited, London, to take Lloyd's highest class. The deck erections consist of poop, raised quarter-deck, long bridge and topgallant forecastle. A handsome saloon and accommodation for officers and a few passengers will be fitted up in the poop, and comfortable quarters for the crew in the fore part of the bridge. The hull is built with web frames, and a cellular double-bottom is fitted throughout. A large donkey boiler, four steam winches, steam steering gear amidships, screw gear aft, patent direct steam windlass by Emerson Walker Co. Boats on beams overhead, and all modern appliances will be fitted. The engines are of the triple-expansion type, of 800 H.P., working on three cranks, and are supplied by the Central Marine Engine Works of William Gray & Co., Limited. The cylinders are 20 in., $31\frac{1}{2}$ in., and 53 in. diameter, with a piston stroke of 36 in. The boilers built of steel, are of large size, and will give an ample supply of steam at a working pressure of 160 per square inch. The vessel has been superintended during construction by Captain T. Pyman on behalf of the owners. The ceremony of naming the ship *Ariadne Alexandra* was gracefully performed by Mrs. Rodocanachie, of London.

Baracaldo.—On July 15th Messrs. William Gray & Co., Limited, launched the *Baracaldo*, which has been built to the order of Ramon de la Sota, of Bilbao. She is a fine, handy steamer, taking Lloyd's highest class, and her dimensions are:—Length, overall, 239 ft.; breadth, 30 ft.; depth, 16 ft. $9\frac{1}{2}$ in. She has a poop, raised quarter-deck, bridge, and topgallant forecastle, is built with web frames, and double bottom under each hold, and will be thoroughly equipped with donkey boiler, steam steering gear, four steam winches, patent direct steam windlass by Emerson, Walker & Co., &c., for general trading. She will have triple-expansion engines made at the Central Marine Engine Works of Messrs. William Gray & Co., Limited, having cylinders $16\frac{1}{2}$ in., 26 in., and 44 in., with a piston stroke of 33 in., and a large steel boiler to work at a pressure of 160 lbs. per square inch. The ceremony of naming the ship *Baracaldo* was gracefully performed by Mrs. G. H. Baines, of West Hartlepool.

Bathurst.—On Saturday, July 15th, the Naval Construction and Armaments Co. launched from their shipbuilding yard at Barrow-in-Furness the s.s. *Bathurst*, built to the order of the British and African Steam Navigation Co., Limited, of Glasgow. This is the second of three vessels on order for this company. The christening ceremony was gracefully performed by Mrs. George Hutchinson, of The Grove, Upholland. The *Bathurst* is 336 ft. long, 39 ft. 3 in. beam, and 25 ft. moulded depth and is built to the highest class at Lloyd's. She is constructed under the three deck rule and cellular double bottom principle, water ballast being carried nearly the whole length, and has two complete decks and a poop bridge and forecastle, the upper deck being sheathed with wood. She is sub-divided into seven water-tight compartments. When finished she will be rigged as a fore and aft schooner, the masts being built of steel, and will be propelled by powerful inverted direct-acting triple-expansion engines of the most improved type, the cylinders being 23 in., 38 in., and 63 in. diameter, by 42 in. stroke, capable of developing 1,600 H.P., which will drive the ship at $11\frac{1}{2}$ knots, loaded. The steam will be supplied by two large steel single-ended boilers, constructed for a working pressure of 180 lbs. per square inch. The vessel is designed as a first-class passenger steamer, and fitted with all the latest improvements suitable for the African trade. On the upper deck amidships, under the bridge, there is accommodation for 48 first-class passengers, including dining saloon, ladies' cabin, and pantry; also the engineers' room, galley stores, bath-room, w.c.'s, &c., &c. On the bridge deck, which forms a very fine promenade, there are the first-class smoke-room and ladies' drawing-room. The second-class passengers, 14 in number, are accommodated under the poop, as are also ship's officers, stewards, &c. The crew's quarters are fitted up under forecastle deck. The arrangements for the accommodation of passengers are of the most approved style, the saloon being very spacious and particularly well lighted and ventilated. A complete system of electric lights will be fitted in passengers', officers', and crew's spaces, also cargo lights. For loading and discharging cargo special arrangements have been made, there being two powerful steam cranes in addition to four winches, steam for these being supplied by a donkey boiler placed in the side casing.

James Tennant.—On July 15th there was launched from the yard of Messrs. Wood, Skinner, & Co., at Bill Quay-on-Tyne, a steel screw steamer, built to the order of Messrs. T. Thompson & Son, Newcastle. The vessel is of the raised quarter-deck type, and has been specially designed for the coasting trade. The engines have been constructed by the North-Eastern Marine Engineering Co., Limited, Wallsend, to whose works the vessel was towed immediately after the launch. The ship and engines have been built under Lloyd's special survey for 100 A1 classification. The vessel on leaving the ways was named *James Tennant*, the ceremony being performed by Miss Kent, of Heaton.

Linden.—On July 15th there was launched from the ship-building yard of Messrs. William Dobson & Co., Low Walker, a steel screw steamer, which has been built to the order of Messrs. J. G. Charlton & Co., of Newcastle. The vessel is 163 ft. long, 23 ft. beam, and 11 ft. 8 in. depth, moulded. She is fitted with a partial double bottom for water ballast, and all the latest appliances for the rapid loading and discharging of cargo in the trade for which she is intended. The machinery for the vessel is of the triple-expansion type, having cylinders 13 in., 20 in., and 33 in. by 24 in. stroke, with ample boiler power. It is being made by the North-Eastern Marine Engineering Co., Limited. On leaving the ways the vessel was named the *Linden*, by Miss Charlton, and immediately afterwards was taken to the engineers' works at Wallsend to receive her machinery.

Zaire.—On Saturday afternoon, July 15th, there was launched from the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesbrough, a very fine steel-screw passenger and mail steamer which has been built to the order of Messrs. Empreza Nacional de Navagacao, of Lisbon, under the superintendence of Captain T. C. Laws, of Liverpool. The vessel is built to Lloyd's spar-deck rule, and will take their highest class, her principal dimensions being:—Length, 350 ft. 6 in.; beam, 42 ft. 2 in.; depth, moulded, 28 ft. 9 in. The spar-deck is of steel, sheathed with teak, and main deck of steel sheathed with yellow pine, water ballast is fitted in cellular double-bottom, and in deep tank aft. Accommodation for about 250 passengers will be fitted up on the main deck, together with rooms for mails, plate, linen, luggage, &c. The vessel will be lighted throughout with electricity. Engines by Messrs. T. Richardson & Sons, of Hartlepool, will be supplied, and a high sea speed will be maintained. As the steamer was leaving the ways she was named the *Zaire* by Mrs. Laws, the wife of T. C. Laws, Esq., of Liverpool, the superintendent of the company.

Rhone.—On July 20th Messrs. Cookrane & Copper launched at Grovehill, Beverley, a steam trawler, built for Mr. G. F. Slight, Weelsby Hall, Grimsby. The vessel was named the *Rhone*. The *Rhone* is 87 ft. by 20 ft. by 10 ft. 8 in., and is fitted with 44 N.H.P. compound s.c. engines by Messrs. C. D. Holmes & Co., Hull.

Dart and Derwent.—On July 20th two additions were made to the fishing fleet of Messrs. Morris & Jeffs, jun., of Grimsby, by the launching of two iron steam trawlers from the yard of Earle's Co. at Hull. The vessels were named the *Dart* and *Derwent*.

Lachesis.—A steel screw steamer, the *Lachesis*, built to the order of the Port of London Sanitary Authority, has been launched by

Messrs. Willoughby Brothers, Limited, at Plymouth. The dimensions are:—71 ft. by 13 ft. 6 in. by 7 ft. engines (compound surface-condensing), 11 in. and 21 in. with 18 in. stroke; boiler for 100 lbs. working pressure. This steamer is intended for use for the sanitary inspection of shipping in the lower reaches of the Thames, and for removal of any sick.

LAUNCHES—Scotch.

Aggie.—On June 29th Messrs. John Fullerton & Co., Paisley, launched a steel screw-steamer of about 200 tons, which has been built to the order of Messrs. M'Kinney & Rafferty, fish salesmen, Glasgow, for their fish-carrying trade, and is the fourth steamer supplied by Messrs. Fullerton to same owners. Compound engines of 400 I.H.P. will be supplied by Messrs. Ross & Duncan, Whitefield Works, Govan, the steamer leaving immediately after the launch to receive same. Miss May Rafferty, 3, Princes Square, Strathbungo, named the steamer the *Aggie*.

Beryl.—On June 29th there was launched from the shipbuilding yard of Messrs. Scott & Sons, Bowling, a screw steamer named *Beryl*, built to the order of Mr. William Robertson, 15, Gordon Street, Glasgow, for his general coasting trade. The dimensions of the vessel are:—142 ft. 6 in. by 25 ft. by 12 ft. The engines, which are compound surface-condensing, are being supplied by Messrs. Ross & Duncan, Govan. On moving down the ways the steamer was named by Miss Nora Mills, Walmer Crescent, Glasgow.

Elmwood.—On July 1st Messrs. Russell & Co. launched from Kingston Yard, Port-Glasgow, a three-masted barque named *Elmwood*, of 335 tons register, capable of carrying 600 tons deadweight, to the order of Messrs. Petersen, Honeyman & Co., Glasgow. Dimensions:—Length, 145 ft.; width, 27 ft.; depth, 11 ft. 8 in. She has been masted by the builders, and rigged on the stocks by Mr. John Niven, and has had about 250 tons ballast put aboard. She was launched fully rigged, equipped, and provisioned, with crew aboard, and immediately after being launched proceeded to sea. The time taken from the laying of the keel to launching the vessel complete for her voyage is within two months.

Holywood.—On July 1st the Ailsa Shipbuilding Co. launched from their yard at Troon a handsome steel sailing barque for the Village Line of Messrs. Guthrie Macdonald, Hood & Co., Glasgow. The following are her principal dimensions:—Length between perpendiculars, 247 ft.; breadth, moulded, 38ft.; depth, moulded, 23 ft.; and she will have a deadweight carrying capacity of about 2,700 tons. She is a sister ship to the *Dunreggan*, built by the Ailsa Co. for the Village Line last year, and, like her, has been built under special survey and to Lloyd's highest class, and will have a complete outfit of all the most modern appliances. Captain Young, of the Village Line, has superintended the construction throughout. The christening ceremony was gracefully performed by Miss Nancy L. Edmiston, of Ibrox House, Ibrox, the ship being named *Holywood*. The owners and builders, with a numerous party of friends, adjourned to the moulding loft after the launch, and drank success to the *Holywood* and the Village Line, to which Bailie Guthrie suitably replied. Amongst others present were—Provost M'Isaac, Saltcoats; ex-Provost Ferguson, Ayr; Mr. John M. Campbell, Mr. J. R. Harrison, Captain Tessier, Mr. James Wyllie, Mr. Alexander Wyllie, Mr. Thomas Smith, Mr. Alexander Brownlee.

Osprey.—On July 4th the *Osprey*, a steam trawler of about 140 tons, for the Great Grimsby Ice Co., was launched by Messrs. Mackie & Thomson, at Govan. The vessel, which is 97 ft. 6 in. long, 20 ft. 6 in. broad, and 11 ft. 7 in. deep, will be supplied with triple-expansion engines by Messrs. Muir & Houston, Kinning Park.

Rameses.—On Tuesday afternoon, July 4th, Messrs. R. Napier and Sons launched from their shipyard at Govan, a steel cargo and passenger screw steamer for the Moss Steamship Co., Liverpool. This new steamer has been specially designed by Messrs. William Esplen and Son, Liverpool, for the company's Mediterranean service, and has been built under their inspection to class 100 A1 Lloyd's three-decked rule on the deep frame principle. The general dimensions are:—Length between perpendiculars, 320 ft.; breadth, moulded, 38 ft.; depth, moulded, 24 ft. 7 in.; with a top-gallant forecastle, long bridge-house, and full poop. Superior accommodation has been provided in the fore part of the bridge-house for first-class passengers, and is fitted with the most modern appliances for their comfort, while the second-class and officers have hardly inferior accommodation in the poop. The machinery consists of a set of triple-expansion engines, and two single-ended boilers for a working pressure of 200 lbs. per square inch, with the most recent improvements for efficiency and economy. The word being passed that all was ready, Miss Eleanor M. Moss cut the lashing that held the ship with a little mallet and chisel, and named her the *Rameses*. After a most successful launch the vessel was towed up the harbour to receive her machinery, which has been constructed at the builders, Lancefield Works.

Southwark.—On July 4th Messrs. William Denny & Bros., Dumbarton, launched the twin-screw steamer *Southwark*, built by them to the order of the International Navigation Co. This magnificent steel steamer can well be claimed to be the largest deadweight carrier afloat. Her dimensions are:—480 ft. by 57 ft. by 40 ft., and she will carry 10,000 tons. The vessel is fitted with direct-acting, surface-condensing, quadruple-expansion machinery, having four cylinders working on four cranks; cylinders, 25½ in., 37½ in., 52½ in., 74 in., with a stroke of 4 ft. 6 in., by Messrs. Denny & Co. The working pressure is 200 lbs., and the boilers are fitted with the new induced draught system of Messrs. Brown, and Serve tubes. By this means a large amount of power is got from boilers occupying a very small space. This steamer has been constructed in excess of the Bulkhead Committee report, and will be absolutely unsinkable with any two, and in some cases with any three, compartments open freely to the sea. As to the question of strength, this has been carefully considered, not only by the owners, the architect, Professor Biles, and the builders, but also by Lloyd's, to whose highest class she is built. While primarily intended for cargo-carrying purposes, she is also fitted for a limited number of passengers. Accommodation in the citadel is provided for 80 passengers in well-appointed state-rooms, while the dining-room is situated on the top of the citadel deck. The 'tween decks are large, airy, and well lighted, and will give accommodation for 1,000 third-class passengers. Of course this steamer, like all first class modern steamers, is fitted with electric light, refrigerating gear, and all the latest improvements both in the ship and engine departments. Seldom has the yard of Messrs. Denny & Bros. been so crowded with spectators as it was on above date, to witness this leviathian taking the water. Not only was the yard crowded, but every available inch of ground in the near vicinity of it, more especially the slopes of the historic Dumbarton Rock, were black with people, who watched with keen interest for the moment when the vessel would take the water. The company at the launch included the following:—Mrs. Griscom, wife of the president; Mr. James Spence, of Messrs. Richardson, Spence & Co., managing agents of the company in this country; the Misses Spence, Mr. Henry Wilding, Southampton; Professor Biles, Mr. F. S. Cochrane, sen.; Mr. F. S. Cochrane, jun.; Captain Rogestvensky, naval attaché to the Russian Imperial Embassy, London; Colonel Poretchkin, Lieutenant Dobrotvorsky, Mr. Thom and Mr. Jamieson, the resident superintendents of the company; Captain Jackson, Fleetwood; Mr. A. T. Gibson, Fleetwood; Mr. Hayes, Fleetwood; Mr. John Darling, Mr. A. B. Brown, Edinburgh; Captain and Mrs. Darling, Mr. and Mrs. R. E. Findlay, Mr. and Mrs. John Crookston, General and Mrs. Gildea, Mr. and Mrs. Adair Campbell, the members of the builders' firm, &c. The ceremony of christening the vessel was gracefully performed by Mrs. Griscom, and the launch was a most successful one. The large company thereafter adjourned to the model hall, where the usual toasts were pledged.

Twin-Screw Hopper Steamer.—On July 5th Messrs. Wm. Simons & Co., Renfrew, launched complete from their yard a large hopper steamer for the Clyde Trustees. The leading dimensions of which are:—Length, 205 ft.; breadth, 35 ft.; depth, 15 ft. 6 in. The hopper has a capacity for 1,200 tons of material. The vessel is propelled by two sets of triple-expansion engines and twin-screws capable of steaming at a speed of 10½ knots per hour when loaded. It is built under the British Corporation requirements and survey. This makes the eleventh vessel that William Simons & Co. have built for the Clyde Trust, their connection extending as far back as 1861, when they built for them two hopper barges, which were the first vessels of this class propelled by steam. A number of the members of the Trust were present at the launch, and as the vessel entered the water the ceremony of naming it *No. 21 C.N.*,

was performed by Miss Daisy Deas, daughter of Mr. James Deas, C.E., engineer to the Trust.

Potamac.—On July 18th Messrs. Inglis & Co., of Pointhouse Yard, launched a large oil boat, built for the Anglo-American Oil Co. It is 345 ft. long, 44 ft. wide, and 31 ft. deep, and is built to carry 5,700 tons of oil and coal. It is to be fitted with engines of 3,000 H.P. of the latest and strongest pattern. She was christened the *Potamac* by Mrs. Robert Lyle, of Greenock, in the presence of a large number of spectators.

Senorita.—On July 15th Messrs. Cumming & Ellis, launched from their shipyard at Inverkeithing, another handsomely modelled steel barquentine, being a sister ship in all respects to the *Marie Louise* recently launched by this firm. The vessel has been built to the 100 A1 class at Lloyd's and to carry 615 tons deadweight, and is of the following dimensions, namely—140 ft. by 27 ft. by 12 ft. 2 in. moulded. She is also fitted out to Board of Trade requirements in all respects. The vessel is intended for trade on the South American Coast, and all her deck and other arrangements are suited to this trade. She is barquentine rigged, lower masts, bowsprit, yards, &c., being of steel, and all the rigging throughout of best steel wire in accordance with Lloyd's requirements. The captain and officers are berthed in a spacious deck-house aft, neatly and tastefully fitted up in every way, the crew being in another deck-house forward instead of in the forecastle. All the deck fittings about the vessel are of the most modern description, and by well-known makers, and she will be very completely fitted out for the trade in which she is intended for. As the vessel left the ways she was gracefully christened the *Senorita* by Mrs. R. Elwood Ellis, wife of one of the builders in the usual orthodox manner. After the launch the visitors adjourned to the builders' model-room where the usual toasts on such occasions were given and responded to. The vessel will be commanded by Captain Torjusen, who has superintended the construction. We may mention that this vessel carries the above named deadweight of 615 tons on the unusually small registered tonnage of 312 tons.

LAUNCHES—Irish.

Gothic.—On Wednesday, 28th June, there was launched a large twin-screw steamer named the *Gothic*, from Messrs. Harland & Wolff's yard, Belfast, the latest addition to the well known fleet of White Star steamers. The dimensions are: Length, 490 ft.; breadth, 53 ft.; and depth of hold, 37 ft. 6 in.; and the gross tonnage about 7,500. Although it is probable that the *Gothic* may make a few voyages in the New York service, as the bookings of the White Star Line continue to be heavy for the autumn season, it is intended that she shall ultimately take her place with her predecessors the *Ionic*, *Doric* and *Coptic*, and the steamers of the Shaw, Savill & Albion Co., the *Arawa* and *Tainui* in the New Zealand trade, sailing from Plymouth each month and calling at Teneriffe, Cape Town, and Hobart outwards, and Rio de Janeiro and Teneriffe homewards. The distance traversed on each round voyage exceeds 26,000 miles, and in thus for the first time introducing twin-screws into the New Zealand trade, the owners of the White Star Line believe they are acquiring an additional element of safety. Elaborate accommodation of the highest class, similar in character to that in the *Teutonic* and *Majestic*, has been arranged for 104 saloon passengers amidships, the dining-saloon and many of the better state-rooms being above the main deck, so that the ventilation will be as complete as possible and in the control of passengers themselves. In the quarter-deck aft accommodation will be provided for 114 steerage passengers. In addition to ordinary coal and cargo space, this steamer will be fitted with two of Hall's refrigerating machines on the carbonic anhydride system, which has already proved economical and successful in several of the large freezing establishments in New Zealand, and will have an insulated capacity for some 75,000 carcases of sheep. The *Gothic* will be the largest steamer as well as the largest carrier in the Australian and New Zealand trades, and as a new departure her appearance is naturally looked for with much interest by Colonial shippers.

Sachem.—On June 29th Messrs. Harland & Wolff launched at Belfast the steel screw steamer *Sachem*, built for Messrs. George Warren & Co., of Liverpool, and intended to run in that company's line between Liverpool and Boston. The new ship has a gross tonnage of about 5,230 tons, and will be fitted with triple-exansion engines, which have also been made by Messrs. Harland & Wolff.

LAUNCH—American.

Merida.—There was lately launched from the yard of Messrs. F. W. Wheeler & Co., West Bay City, Mich., U.S.A., the steel steamer *Merida*, built for Mr. D. Whitney, Detroit, Mich. The vessel is 377 ft. 6 in. long, 45 feet beam, and 25ft deep. Motive power is supplied by a set of triple-expansion engines, having cylinders 23 in., 37½ in., and 63 in. diameter by 44 in. stroke.

LAUNCHES—German.

Amrum.—There was lately launched at Rostock, Germany, the steel cargo steamer *Amrum*, of 1,200 tons, built for Messrs. Lange Bros., Hamburg, for the Baltic, North Sea, and Mediterranean service.

Saturn.—On June 24th there was launched from the yard of Herr G. Seeback, at Geestemünde, Germany, the steam tug *Saturn*, built for the North German Lloyd. The vessel is 104 ft. long, 18 ft. 6 in. beam, and 11 ft. 6in. deep.

LAUNCH—Italian.

Mayba.—There was lately launched from the yard of Messrs. Odero & Co., of Sestri Ponenti, Italy, the paddle steamer *Mayba* of 650 tons, built for the Royal Servian Co. for service on the Danube.

TRIAL TRIPS.

Taygeta.—On June 15th the new steamer *Taygeta*, built by the Flensburg Shipbuilding Co., made her first trial trip. This steamer was built to the order of Messrs Holm & Molzen, of Flensburg, and was constructed for the coal and timber trade, her dimensions are:—243 ft. by 34 ft. by 17 ft. 2 in., with 500 I.H.P. She made an average speed of 10 knots.

Sea Gull.—On June 24th the *Sea Gull* (s.), recently launched by Messrs. John Fullerton & Co., Paisley, proceeded down the Clyde on her trial trip. On reaching Skelmorlie the measured mile was run four times, giving a mean speed of one knot per hour over contract. The engines, which worked in a satisfactory manner during the whole day's steaming, have been supplied by Messrs. Ross & Duncan, Govan.

Cleopatra.—On June 27th this splendid yacht of 660 tons, the property of Mr. John Lysaght, of Bristol, left Leith direct for Norway with the owner and a large party of friends. On the 15th June the full speed and progressive trials were run in presence of Mr. G. L. Watson, the designer, when a mean speed of 12¾ knots was easily attained, the engines working throughout with perfect smoothness and entire absence of vibration. This is the fourth yacht built by Messrs. Ramage & Ferguson, Limited, for Mr. Lysaght.

Glen Rosa.—On June 27th the new paddle steamer *Glen Rosa*, which has been built by Messrs. James & George Thomson, Limited, Clydebank, for the Glasgow and South-Western Railway Co., went on a trial in the Firth of Clyde. A mean speed of 17·75 was obtained, the engines working with remarkable smoothness throughout the trial. Her length is 200 ft., and the moulded breadth 20 ft. The extreme breadth, however, is about 50 ft. She has been specially designed for service on the lower part of the Firth.

Saturnus.—On June 28th the above vessel, built and engined by Messrs. John Scott & Co., of Kinghorn, for Messrs. MacLeod Bros. & Co., of London and Manila, was taken from Burntisland for her official six hours trial trip in the Firth of Forth. The vessel is 200 ft. by 29 ft. by 21 ft. to upper deck, and is built of the awning-deck type with cellular double-bottom throughout. She has splendid accommodation for a large number of 1st and 2nd class passengers. The engines are of the usual triple type, and worked throughout the trial without a hitch of any kind, the vessel attaining a speed of over 13 knots per hour to the entire satisfaction of the owner and his consulting engineer, Mr. A. C. Hay, of Liverpool, who were both on board. Se has been built expressly for the Manila trade.

H. A. Nolze.—On July 1st this steamer made her trial, she is built by the Flensburg Shipbuilding Co. to the order of the Steamship Co., Neptun, in Bremen. She is classed to Bureau Veritas highest degree, and built on the double raised quarter-deck principle. She is built for the trade with Portugal, and has

dimensions:—188 ft. 6 in. by 26 ft. 9 in. by 15 ft. 2 in., and engines of 300 H.P., with which she run an average speed of 10½ knots.

United.—On July 1st the final trial was made of the twin-screw tug *United*, built by Messrs. R. & H. Green, of Blackwall, and engined by Messrs. Alex. Wilson & Co., Limited, Vauxhall Iron Works, Wandsworth Road, London. The vessel is for service at East London, South Africa, the dimensions of the hull being 103 ft. long by 21 ft. beam by 9 ft. draught, and the conditions of the contract in regard to speed, draught and stability were so onerous in order to obtain the best possible results, that Messrs. Green only secured the contract by undertaking to carry it out strictly in accordance with the terms of the specification, and which necessitated the use of materials of the highest class for both hull and machinery. The hull is built of iron, as being less liable to corrosion than steel, at a port where the opportunities for docking frequently are fewer than in a home port. This, however did not apply to the boiler and machinery, which are of steel throughout, the propellers being of manganese bronze; both the vessel and machinery being also constructed under Lloyd's survey for the highest class. A speed of 12 knots was obtained throughout a four-hours' run between Gravesend and the Nore, the engines maintaining a uniform speed of 150 revolutions, indicating 710 H.P. The engines, which are two in number, are of the compound type, having cylinders 15¼ in. and 30½ in. diameter by 21 in. stroke, with extra large cooling surface in the condensers, and are fitted with the circular balanced and double-ported valves which Messrs. Wilson have now used for a number of years with the greatest success. The consumption of coal was only 1·9 lbs. per H.P., which is extremely low for a compound engine, and was due to the high rate of expansion, the valves being set to cut off at half-stroke, the boiler-pressure being 100 lbs. The consulting and inspecting engineers were Messrs. John Thompson & Son, London Street, E.C., this being the sixth vessel built by Messrs. Green and engined by Messrs. Wilson, under their supervision.

Archibald Finnie.—On July 4th this steamer, which has been recently built by Messrs. Fleming & Ferguson, Paisley, to the order of Messrs. Arch, Finnie & Son, Kilmarnock, for their coasting trade, went down the river for loaded trial. Her dimensions are 175 ft. by 26 ft. 6 in. by 13 ft., and she is fitted with set of the builders' patent quadruple expansion engines to indicate 850 H.P. The machinery worked splendidly, and the trial was in every way satisfactory to the owners and party on board.

Twin-Screw Hopper Steamer—The second of the twin-screw steamers ordered from Messrs. Fleming & Ferguson, Paisley, by the Clyde Navigation Trustees, in February last, has now been completed, and on Saturday, July 8th, run her speed trial between Cloch and Cumbrae Lights. The run was made with and against tide, over a distance of 27½ knots, on which distance she attained a mean speed of 10¾ knots, being ¼ knot in excess of speed stipulated for by the trustees. The steamer carried her load within her specified draught, and trial was in every way a success, the machinery and everything about the vessel giving the most entire satisfaction to the representatives of the trustees who were on board.

Warren Hastings.—On July 8th the s.s. *Warren Hastings*, a 4,000 ton troopship, built for the Indian Government by the Naval Construction and Armaments Co., ran a trial trip in Morecambe Bay, and covered the distance from Barrow Harbour to and from Morecambe lightship several times at a mean speed of about 18 knots, two knots above her contract speed. She will leave in a few days direct for Bombay.

Catalina.—On July 11th the steamer *Catalina*, built by Messrs. Charles Connell & Co. Whiteinch, and engined by Messrs. Dunsmuir & Jackson, Govan, ran her official trial trip. She has been built to the order of Messrs. Pinillos, Saenz & Co., Cadiz, under the superintendence of Captain Abrisqueta, and is intended to ply between Barcelona, Cadiz, Havana, and the Gulf of Mexico ports. Her dimensions are 400 ft. by 48 ft. by 31 ft., and she is driven by a set of the usual type of triple-expansion engines, having cylinders 29 in., 46 in. and 74 in.; stroke 51 in., with two large double-ended boilers, and all the latest improvements, including Weir's pumps, heater, evaporator, and bronze propeller blades. The deadweight capacity of the vessel is 6,806 tons, and, in addition, she has accommodation for 70 first-class passengers and 60 second-class passengers, and 300 emigrants. The speed attained, with about 4,500 tons on board, at 70 revolutions, was 12¼ knots. Everything worked satisfactorily, and the vessel left for Cadiz immediately after the guests had gone ashore.

Twin Screw Steam Hopper Barge.—On July 12th the twin-screw steam hopper barge *No. 21*, recently ordered by the Clyde Trustees from Messrs. Wm. Simons & Co., completed its official trials with most satisfactory results. It was loaded with over 1,200 tons of sand, which it carried within the specified draught. Runs were then made with and against the tide between the Cloch and Cumbrae Lights, with the result that the speed was found to be in excess of the contract. There were present at the trials Mr. Jas. Deas, engineer to the Clyde Trust, Mr. Geo. H. Baxter, mechanical engineer, Mr. McIntosh, river superintendent, and the surveyor to the British Corporation of Shipping, and the builders were represented by Messrs. Brown.

Stolzenfels.—On Tuesday morning, July 18th, the s.s. *Stolzenfels* left the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesbrough, for the customary trial of machinery, &c., before being handed over to her owners, Messrs. The Deutsche Dampfschiff-fahrts Gesellschaft "Harsa," of Bremen, to whose order she has been built, for their East Indian trade. The construction of the vessel has been under the superintendence of Captain Hansen. The principal dimensions are:—Length, 327 ft.; beam, 41 ft.; depth, moulded, 29 ft. She is of the spar-deck type for Lloyd's highest class, the spar deck being of steel, sheathed with teak. The holds are fitted with web frames, and water ballast is provided for in cellular double bottom. A very full outfit of cargo-working machinery of good power is fitted, as well as steam steering gear, steam windlass, &c., &c. The engines are by Messrs. Thos. Richardson & Sons, of Hartlepool, the cylinders being 24 in., 38 in. and 64 in. by 42 in., with large steel boilers working at 160 lbs. pressure, which have been designed to fulfil the requirements of the law of Germany as well as Lloyd's. During the trials everything was found most satisfactory, and the steamer proceeded to Blyth to load her first cargo.

Thomas Wayman.—On July 19th the screw steamship *Thomas Wayman*, built by Messrs. John Readhead & Sons, West Docks, South Shields, had her trial trip off the Tyne. The vessel is owned by the Charlton Steam Shipping Co., Limited, of which Mr. Thomas Wayman, M.P. for the Elland Division of Yorkshire, is the chairman, and Messrs. Charlton, M'Allum, & Co., of Newcastle, are the managers, and she is of the following dimensions:—Length, 280 ft.; breadth, 38 ft.; depth, moulded, 22 ft. Her deadweight capacity is 3,400 tons, and she is classed 100 A1 at Lloyd's, special survey. She is of the improved well-deck type, and is fitted with all the latest appliances for rapid discharging of cargo. The engines, also built by Messrs. Readhead, are on the triple-expansion principle, having cylinders of 21 in., 35 in., and 57 in. by 39 in. stroke, and the working pressure being 160 lbs. Steam is supplied by two steel boilers, in each of which are three patent furnaces. The steamer had the usual runs over the measured mile, her mean speed being equal to 10½ knots per hour. Everything passed off to the entire satisfaction of the owners and builders.

Christina.—On July 20th the steel screw steamer *Christina*, of 500 tons, which was built by Messrs. S. M'Knight, shipbuilders, Ayr, to the order of Murphy Bros., coal merchants, Waterford, and launched on the 13th of June, went down the Firth of Clyde with a select party of gentlemen on board, on her official trial, and attained a speed of 13½ knots. Her dimensions are:—Length, between perpendiculars, 165 ft.; breadth, 26 ft.; depth, 13½ ft. Her engines were supplied by Messrs. Muir & Houston, engineers, Glasgow; cylinders, 23 in. and 46 in. diameter by 33 in. stroke; boiler, 13 ft. diameter by 10 ft. 6 in. long; 120 w.h. She is classed at Lloyd's 100 A1, was built under special survey, was specially designed for the owner's own trade, and has all the latest improvements for a coasting steamer.

Benjamin Constant.—The war vessel *Benjamin Constant*, built at Les Chantiers de La Seyne, France, for the Brazilian Government, for use as a naval school, was lately taken for her trial trip. The vessel is 236 ft. long, 44 ft. 7 in. beam, with a draught of 18 ft., and a displacement of 2,750 tons. As the vessel is arranged for navigation both under sail and steam, the motive power only consists of one set of engines of 2 800 H.P.,

by which at the trial a speed of 14 knots was attained. The armament of the vessel will comprise four 15 c.m. quick-firing guns, eight 12 c.m. guns, two 57 m.m. machine guns, six Nordenfeldt guns, and three torpedo tubes.

Shell Drake.—The screw liner *Shell Drake*, built by W. Fulton, of Pittenweem, and engined by Messrs. Tweedy Bros., of North Shields, to the order of J. O. Spence and partners, went on trial off the Tyne last month, and had a successful run as far as Blyth, the measured mile being taken on the way back, when the vessel maintained the mean speed of 11 miles per hour.

Correspondence.

[It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—ED. M. E.]

THE GERMAN EMPEROR'S YACHT "METEOR."

To the Editor of THE MARINE ENGINEER.

DEAR SIR,—I notice in your issue of this month it is stated that the German Emperor's yacht, *Meteor*, is painted with a foreign composition, which it is intended to introduce into this country. We desire respectfully to say that this vessel, since her launch as the racing yacht *Thistle*, has always been painted with our "Electroid" composition. We have also had the pleasure for the last three seasons, since she was owned by the German Emperor, of supplying paint for her, under her new name, supplemented with orders for the requirements of the Emperor's steam yacht, *Kaiser Adler*. In the interests of the good name of our home paint manufacturers, as well as of ourselves, I am sure you will give this matter the like publicity of the other announcement.

I am,
Yours truly,
WILLIAM J. H. ADAM, Secretary.

July 13th, 1893.

Iron ship-plates at Middlesbrough are quoted at £4 10s., 30s. less than two years ago; iron bridge plates, £5, 25s. less; steel ship and bridge plates, £5 10s., as against £7 10s. four years ago; and steel rails £3 15s., against £5.

The Junior Engineering Society have recently visited the Deptford station of the London Electric Supply Corporation, and the Blackwall Tunnel Works, where the members descended one of the caissons and passed to the working face, where the cutting shield was seen in operation driving the tunnel.

Phosphor Bronze.—In our paragraph under this heading last month we fell into two very palpable errors, which we take the earliest opportunity of correcting, though the mistakes must have been apparent to all interested in the subject. We spoke of the propeller blades being of phosphor bronze, and the torpedo boat plates of Bull's metal. Of course we should have reversed the two. Under the picture of the little craft the particular alloy used is very plainly specified.

New Manager for Fairfield Shipbuilding Works.—Mr. Edward Sharer, who has for five years been manager of Edwards' Shipbuilding Yard on the Tyne, has been selected to fill the position of general manager of the Fairfield Shipbuilding Yard, Glasgow, in succession to Mr. White. Mr. Sharer, who belongs to Port-Glasgow, is 36 years of age. He was educated at St. Andrew's, and served his apprenticeship in the shipbuilding establishment of Messrs. Robert Duncan & Co., Port-Glasgow. He subsequently joined Liverpool Lloyd's Registry as surveyor. After that he started shipbuilding at Sunderland, where he remained about six years, when he joined Edwards' Shipbuilding Co. as partner and general manager.

The Suez Canal.—An interesting index of the prosperity of the Eastern trade is afforded by the returns of the Suez Canal Co. It will be seen that the year 1891 seems to have marked high water for the present at least. In number of vessels, gross and nett tonnage passing, in passengers carried through, and in receipts, 1892 is inferior to its predecessor, though it surpasses 1890. When we regard the flags of ships using the Canal we see that the British proportion to the total is lower as in the Dutch and Italian, whilst the French, German, Austrian, Norwegian, Spanish, and miscellaneous, are increasing. Indeed the steady increase in the proportion of minor clients to the total is perhaps the most remarkable feature of the table. Of course the size of vessels using the Canal increases as the size of ships generally is increased. Accordingly we are not surprised to see that the mean tonnage of ships passing through in 1892 was just 100 tons more than in the previous year. Similarly we find that with the introduction of electric lighting into modern vessels the percentage of ships passing by night is increased to 90 per cent. of the total.

	1890.	1891.	1892
Number of vessels using the Canal	3,389	4,207	3,559
Gross tonnage	9,749,130	12,217,986	10,866,401
Nett tonnage	6,890,094	8,698,777	7,712,028
Transit receipts (francs) ..	66,984,000	83,422,101	74,452,436
Per-centage of Flags :—			
British	74·42	76·47	72·52
German	8·11	7·56	8·20
French	4·99	4·07	4·89
Dutch	4·25	3·49	4·97
Italian	2·57	2·76	2·08
Austrian	1·62	1·21	1·71
Spanish	1·00	0·67	0·73
Norwegian	1·27	1·31	1·85
Other Flags	1·77	2·46	3·05
Passengers using Canal ..	168·352	194·473	189·820

(Abstracted from the Parliamentary Report.)

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from June 13th, 1893, to July 12th, 1893.

11554 A. E. Stebbing. "Instantaneous" buoy.
11564 G. A. Crane. Improved steam generator.
11602 E. G. Brewer. (J. H. Williams & W. C. Redfield, U.S.) Wrenches for pipes.
11628 E. Wall. Means for raising sunken ships.
11637 D. B. Wesson. Projectiles.
11682 J. Norris. Compasses.
11694 W. H. Fitzgerald & J. M. Kelly. Boats.
11710 E. Petersen. Tubular steam boilers, &c.
11752 A. Browne. (T. W. Searing, U.S.) Vessel construction.
11760 W. J. Wood. Trawl gangway frame for vessels.
11779 F. F. Fisher. Screw propellers.
11783 T. Armstrong. Propelling apparatus for ships.
11791 H. G. Dunstan & T. Wescombe. Shafting.
11831 J. Bishop. Rudder for sailing vessels.
11878 M. H. Lowe. (A. T. Danks, Australia.) Screws.
11886 C. Smith. Shoots used in loading vessels.
11928 J. Dixon. Automatically loading coal bunkers.
11952. H. H. Doty. Torpedoes.
12018 J. Clarkson & S. Mortimer. Supplying air to furnaces.
12027 J. H. Clarke. Preventing racing in steamship engines.
12045 A. Marty & R. Jannin-Lecomte. Propelling boats.
12048 G. H. Jones. Look-out apparatus for ships.
12059 A. J. Boult. (J. E. Spanoghe, Belgium.) Steam boilers.
12094 C. W. Lancaster. Couplings for shafting.
12098 J. N. Paxman. Steam generators.
12197 J. Sunderland. Heating feed-water.
12246 W. J. Reynolds. Mounting compass cards.
12251 W. R. Pether. Steering vessels.
12255 P. J. Wilson & W. E. Wright. Cranks.
12259 J. Murrie. Utilising exhaust steam from engines.
12295 F. Landerl. Windlass or lifting jack.
12366 A. J. Boult. (R. W. Jenkins.) Navigating instruments.
12372 H. Hunter. Floating, &c. sunken ships.

12385 F. Otto. Propeller.
12405 M. Higgins. Steam generator.
12415 R. MacGregor. Furnace bars.
12431 T. Ellis. Steering marine vessels.
12437 P. Rosling & F. J. A. Matthews. Lubricators.
12454 P. Smit, junr. Shaft driving mechanism.
12467 W. P. Thompson. (L. Gheude & J. Duloit, Belgium.) Masts.
12480 H. O. Bennie. Machine for bending plates.
12485 J. B. Forster. Rudders for stopping ships.
12504 Tangyes, Limited & T. Jefferiss. Valves.
12542 J. Broadfoot. Doors in bulkheads of ships.
12547 W. G. Clark. Coaling of steamships, &c.
12558 W. Chalmers. Boilers.
12581 F. Starr & L. Hucklebridge. Awning for boats.
12602 H. Sheppard. Battleships.
12606 H. Peterson & E. Fernström. Ice boats.
12689 R. Wilcox. Ship's or vessel's propeller.
12698 A. Estivalet. Oars.
12710 S.H.O. Banditz and H. Rasmussen. Life belts.
12717 H. Middleton. Submarine boats and ships.
12730 W. Gray, junr. Steamships and propellers.
12746 A. W. Miller, A. Munro, & J. Mills. Screw propeller.
12760 E. O'Brien. Feeding water to boilers.
12768 C. G. Collins. Dredging apparatus.
12812 W. Morison. Bucket tipping apparatus for steamers.
12817 J. Proctor. Constructing Boiler furnaces.
12285 C. Groombridge & W. A. South. Propeller.
12826 C. & G. Kropp. Hulls or bodies of ships.
12836 A. Blechynden. Tubular steam boilers.
12846 E. H. Hodgkinson. Ships.
12851 W. T. Ward. Link motions for steam engines.
12854 C.C. Walker. (F. Week, Australia.) Crabs or winches.
12876 G. V. Priestley. Steam generators.
12878 J. Robinson. Feed water purifier, &c.
12879 W. J. Cox. Manufacture of Mooring chains.
12909 F. Holderman. Reversing mechanism for counter shafts.
12910 W. P. Ingham. Blast furnaces, shafts, &c.
12926 H. F. Fullagar. Screw propellers.
12948 W. Cochrane. Propulsion of vessels.
12996 H. P. Parkes & J. McAlpine. Steam boilers.
13014 B. W. Maughan. Propellers.
13016 J. W. Ray. Registering direction of ships.
13068 C. Wagener & P. Baumert. Furnaces.
13158 E. W. Begrie. Increasing buoyancy of boats.
13177 T. W. Lees. Self-acting lubricators.
13202 H. F. Fourny. Evaporators for sea water.
13232 E. J. R. Baldwin. Automatic brake for ships.
13240 T. Williams. Air and water propellers.
13289 M. Foster & W. Morrison. Adjustable bearings.
13307 J. J. F. Andrews. Ships for protection from fire.
13312 J. Allen & C. B. Crowe. Closing of watertight doors on ships.
13343 W. Roberts. Locks for ship and other canals.
13360 F. Kennedy. Tubular steam boilers.
13382 W. W. Dunn. Submarine vessels.
13399 F. O'C. Prince. Recovering sunken vessels.
13423 G. E. Killick. Heating water.
13425 M. W. Lowinsky. Recording speed of vessels.
13439 J. I. Thornycroft. Steam engines.
13441 T. D. Hollick. Raising sunken ships.
13455 P. Y. Alexander. Screw propellers.
13459 H. I. Gould & J. W. Bennett. Brakes for ships.
13523 J. A. Morris. Boiler feeding apparatus.
13532 G. Brandau. Closing device for vessels.
13544 J. H. Eickershoff. Steam engines.
13566 J. Y. Johnson. (J. P. Serve, France.) Preventing and removing deposits in steam generators.

BOARD OF TRADE EXAMINATIONS.

July 15th .. H. G. Scott .. .. Ex. 1 C N. Shields.

NOTE.—1C, denotes First Class; 2C, Second Class.

June 24th, 1893.

Anderson, H. T. 1C N.Shields
Beal, Arthur 1C W. Hart'l
Brown, David 1C Liverpool
Brown, John C. 1C Cardiff
Currie, John 2C London
Denby, Alfred 2C Cardiff
Edwards, Dav. 1C Dundee
Evans, E. J. 2C Cardiff
Findlay, H. A. 1C Glasgow
Fletcher, N. B. 2C ,,
Hannah, James 2C ,,
Kidd, John .... 1C N.Shields
Law, George P. 2C Liverpool
Learmonth, J. 2C Glasgow
Lindsay, Peter 2C Dundee
M'Fadyen, A. 1C London
M'Laren, Wm. 1C Cardiff
Newton, Richd. 1C ,,
Reay, Joseph 2C W. Hart'l
Robertson, Wm. 2C Aberdeen
Roe, Ernest E. 2C W. Hart'l
Rome, Wm. 2C Glasgow
Skentelbery, J. 1C N.Shields
Witts, Harry 2C Cardiff
Wylie, Wm. A. 2C Glasgow

July 1st, 1893.

Annan, Alex. 2C S'hampto
Blandon, Wm. 2C Cardiff
Clarke, S. H. 1C London
Common, Jno. 1C Cardiff
Dingle, A. F. 1C London
Evernden, A. S. 2C ,,
French, Jno. H. 2C ,,
Henderson, Jas. 2C Aberdeen
Hodgens, W.J. 1C Hull
Imlay, Jas. C. 1C Aberdeen
Jackson, Isaac 2C Liverpool
Kelly, Patrick 1C ,,
Kendall, Thos. 1C Hull
Lewis, Jas..... 2C London
M'Knight, Wm. 2C Liverpool
Morgan, T. O. 2C ,,
Nicholls, Edwin 1C Falmouth
Nielson, Bjorn 2C Bristol
Old, J. B. .... 1C Hull
Parker, A. H. 2C London
Patterson, A. H. 1C Liverpool
Phelp, A. E. 1C ,,
Pickford, H.Jno. 2C Cardiff
Robinson, G. H. 1C S'nd'rl'nd
Scott, R. S. 2C ,,
Selby, Hy. A. 2C London
Sinclair, F. C. 2C Cardiff
Taylor, C. A. 2C London
Taylor, Wm. 2C Liverpool
Tyrell, Jno. 2C London
Walton, J. H. 2C Liverpool

July 8th, 1893.

Alexander, H. 1C London
Anderson, A. 2C N.Shields
Anderson, J. C. 2C ,,
Ascott, Thos. W. 1C London
Bar, Duncan 2C Glasgow
Brown, Robert 2C ,,
Campbell, D. 1C ,,
Campbell, P. T. 1C N.Shields
Forrest, James 2C Glasgow
Giles, H. J. 2C N.Shields
Hall, Bird .... 1C London
Hanwell, Chas. 2C Liverpool
Harris, H. A. 1C London
Hedley, John O. 1C N.Shields
Hewat, John 2C Glasgow
Johnson, W. R. 2C N.Shields
Lawson, Robert 2C ,,
Mac. Callum, L. 2C Glasgow
Macdonald, A. 1C ,,
M'Ilwraith, J. 1C ,,
M'Gregor, Peter 1C Liverpool
Pettifor, Ernest 2C N.Shields
Potts, Wm. T. 2C ,,
Rae, Robert 1C Liverpool
Reston, Geo. F. 1C N.Shields
Rouse, Wm. J. 1C London
Shirlaw, J. R. 2C ,,
Stevenson, W. 1C Glasgow
Thompson, J. 1C N.Shields

July 15th, 1893.

Archer, D. D. 1C Leith
Barrow, A. E. 2C Liverpool
Bell, Robt. C.W. 1C N.Shields
Binnie, James 2C Greenock
Bowler, Chas. J. 2C London
Crow, F. M. 1C Hull
Cumming, G. P. 2C N.Shields
Davidson, Alex. 2C Greenock
Dawson, Chas. 1C Hull
Doherty, Wm. 1C Leith
Dunn, David 1C Greenock
Eadie, James 1C ,,
Erving, Wm. 2C Leith
Fielden, B. P. 1C London
Galbraith, P. J. 2C Liverpool
Gilmour, Alex. 2C Greenock
Hildreth, Wm. 2C N.Shields
James, Wm. J. 1C London
Jamieson, J. L. 1C Leith
Kain, Edward 1C Liverpool
Lazenby, Hbt. 1C Hull
Loughborough, C. 1C London
Macauley, C. J. 2C Leith
McGee, J. M. 1C London
Mitchell, Alex. 2C Dublin
Moore, Wm. 2C Greenock
Morgan, Harry 2C Hull
Nichols, W. H. 2C ,,
Osborne, John 1C Dublin
Primrose, J. C. 2C Leith
Pritchard, R. 1C Liverpool
Ramsay, Robt. 1C Greenock
Roxburgh, Wm. 2C London
Ryan, John.... 1C N.Shields
Sallanse, A. .. 2C Greenock
Shiels, James 2C Leith
Simpson, W. G. 2C Greenock
Snowball, Frdk. 2C N.Shields
Taylor, James A. 2C Dublin
Toulmin, A. E. 2C Liverpool
Tremain, J. P. 2C Leith

July 22nd, 1893.

Anderson, Robt. 1C Glasgow
Anderson, Wm. 2C ,,
Andrew, David 1C W. Hart'l
Austin, Andrew 1C ,,
Benson, Wm. T. 1C Glasgow
Blay, Alex..... 2C S'th'pton
Broomhall, R.H. 1C Dundee
Cameron, Dnld. 2C Glasgow
Cree, Geo. A. 2C Hull
Crone, Wm. K. 1C London
Dallas, L. A. 1C ,,
Duncan, Jas. 2C Aberdeen
Fawcett, R. W. 2C W. Hart'l
Garrick, W. H. 2C ,,
Glasgow, W. C. 1C Glasgow
Goldsworthy F.J. 2C Cardiff
Harris, Felix 1C ,,
Kidd, Jno..... 2C Aberdeen
M'Allister, Alex. 1C Glasgow
Martin, Wm. 1C Dundee
Mills, G. S... 2C Hull
Munro, David P. 2C Aberdeen
Murray, Jno. 2C N.Shields
Newman, Arthur 2C London
Pearson, Jas. E. 1C Glasgow
Powell, Alex. R. 2C Dundee
Priestly, Ernest 2C N.Shields
Richards Alfred 2C London
Richardson, G. 1C N.Shields
Riley, Wm..... 2C Glasgow
Roberts, D. F. 2C Cardiff
Robinson, W.W 1C W.Hart'l
Salkeld, Jno. D. 2C N.Shields
Sarginson, Wm. 1C W.Hart'l
Shepherd, Jno.P. 2C Hull
Stirling, A. H. 2C London
Sutherland C. 1C Glasgow
Waddleton, J.A. 2C N.Shields
Will, Jno. .... 1C Aberdeen

The Marine Engineer.

LONDON, SEPTEMBER 1, 1893.

THE Naval manœuvres, which have recently come to a close between the Red and Blue Fleets, have unquestionably yielded some surprises and some clear essons. One of the latter, and not the least important among them, is the uselessness of the torpedo catcher to fulfil the purpose for which she is built. The Blue squadron representing an enemy, was supplied with a number of boats, the Red Fleet, which played the rôle of the British squadron, with some dozen catchers, the manifest purpose of the latter being to prevent the former from torpedoing the Red ships. But the boats had it pretty much their own way from the beginning of the operations, and so far as it is possible to judge before the finding of the umpires is made public, the catchers failed to destroy a single one of them. There were torpedo boats destroyed, it is true, but they were destroyed by cruisers or by the fire of the battleships themselves when attacked. Now here we have a matter which needs very careful investigation and consideration. The policy of the Admiralty has been proclaimed from the housetops in this direction. The torpedo boat, the authorities have said, is the arm of the weak naval power, it may exercise a moral power if it is known to exist, but we, the strong naval power, will reply to it by a type of vessel that will wipe it out and destroy both its physical power and the funk it sets up. So the torpedo catcher was evolved. The *Rattlesnake* was the prototype and after several modifications and improvements (?) the *Niger* is the perfected article. Yet strange to say, the *Rattlesnake* is the only vessel of the type for which a word of praise is forthcoming, and the *Niger* is utterly and completely condemned. Why is this? The explanation appears to us simple. The *Rattlesnake* and the *Speedwell*, the only two vessels which answered the demands of their admiral, and the second ship only partially so, have been in commission and in almost constant work. Their officers and their engine-room complements are not new to them, they know their merits and defects, and can get the best obtainable result out of them. The other vessels are commissioned for the manœuvres only, have scratch crews put into them, and when put on their mettle, break down. The remedy is plain. Give the crews of the other vessels more experience and more training and they will reproduce the results of trials which go to show that the power is there if it is only fairly drawn upon. The success of the manœuvres was the *Blenheim* and in a less degree the second-class cruisers of the Naval Defence Act. We have had a great many paper arguments adduced against building big battleships and big cruisers, but these manœuvres are the very best reply to all such. The sea is merciless to small craft. There is no denying this fact. We are taught it by the relative performances of the *Blenheim* and her smaller sisters—the French learn the same lesson with the *Isly* and the *Cecille*. The big cruisers are always ready when wanted, whatever the weather may be. They can steam faster, fight their guns better, and are a match for three or four of the smaller craft. One correspondent says of the *Blenheim*: "She was the mainstay of the Red Fleet." It is not only that the large ship can move faster, but she carries a greater force to exert in the required spot to which she carries it. It was the loss of another big cruiser, the *Narcissus*, that seriously handicapped the Red Fleet at the commencement of the manœuvres, and obliged it to operate for a time on the defensive when it should have been carrying on the war in the enemy's waters. The second class cruisers did good work. They kept up steam and speed until heavy weather affected them adversely, but even then they were capable of much more than any of their predecessors. As scouts they will be invaluable, for they are to be relied on. They might, however, be larger with advantage, and this is a defect which is to be remedied in a newer type. Only instead of three we should have at least three times that number on the stocks. They have another defect as commerce protectors, for only one gun they carry can be fired at a chase without yawing: and yawing means a loss of ground. It is curious that, in ships built for chasing, their arrangement of the armament should be so ill-adapted for the work they are expected to perform. They would not be so wet as they are, were it not for the torpedo discharge tube which is placed above water in the bows. This is another matter which should be looked to. The task imposed upon the Red Fleet was that of clearing the Irish Sea of the Blue vessels and torpedo boats. This was not accomplished—and why? Primarily because the margin of superiority of the Red Fleet was too small. According to the rules, the Reds had a superiority, when all their vessels were present, of 49 points over the Blue, but 50 were required for victory. Unless, therefore, the Blues lost some of their ships it was impossible for Red to win. But it was not Blue that lost ships, but Red—ships which broke down, ships which were torpedoed, and ships which by reason of their insufficient speed could not be brought into action. The engagements between the Fleets were therefore indecisive, and an indecisive action was tantamount to a victory for Blue. There is a lesson for us here, surely the great lesson of the operations. Our margin of naval superiority over possible enemies is a very small one; it has been

diminished already by recent losses. It is, as Lord Spencer pointed out in the House of Lords the other day, diminishing still, for other nations are building, the while we are standing still and marking time. Suppose that we go to war with a small margin, the unforeseen but probable breakdowns and torpedoings diminish it still further; what does it not mean to us? As a foreign critic truly said recently: "The British Empire was founded by her fleet, and that Empire will eventually be held or lost by the supremacy or decadence of England as a naval power."

The efficiency of the engineering staff on steamships is a matter that has been recognised by the majority of the thinking public to be of the highest importance, which importance is much accentuated when dealing with warships. The efficiency of a man-of-war as a fighting machine is in a very large sense wholly dependent upon the skill and care exercised by those in charge of the propelling machinery, as no matter what may be the capacity of the offensive or defensive means in the hands of the commanders, if he cannot manipulate those means to advantage, he may as well, if not better, be without them. The recent changes made in the engine-room complements of ships of war has brought this matter again to the front. Some two or three months ago certain engineering members of the House of Commons had a conference with the First Lord of the Admiralty on this question, and the nature and result of this conference has lately been published in the form of the correspondence that has passed between the parties. Now in the first place it will be conceded by all, that the body of the members of the House of Commons who have thought it their duty to take the matter in hand is composed of gentlemen who are experts in their profession, and are fully qualified to deal with the question on its proper basis. They have stated that the result of the change as a whole, has been to seriously impair the efficiency of the engine-room complements, for three reasons:—Firstly, by the reduction in the number of the men; secondly, by the change in the constitution of the complements; and thirdly, by rendering the service less attractive to highly-trained engineers and mechanics. In dealing with the first reason, the important point is put forward that as the machinery of all kinds now placed on board ships of war is steadily increasing in power, quantity and complexity, the staff of men should be rather increased than diminished. This reason is rendered more forcible when one bears in mind how much more now, than ever it was before, that one set or portion of machinery is dependent on another portion or portions of machinery, and that stricter supervision and care are more necessary than ever in order to prevent the efficiency of the whole being detracted from by the breakdown of a part. The efficiency is further likely to be affected by the radical change in the complement by which the substitution of stokers for engine-room artificers is made, therefore, besides the reduction of the skilled men, some of the skilled men are replaced by men who in their proper sphere carry out their duty in an excellent manner, but who have not that training and knowledge which is necessary in a good mechanic, in the carrying out of his duties with that alacrity, decision, and sound judgment that in certain circumstances is absolutely necessary for a successful issue, hesitation or an unfortunate mistake often entailing consequences that may be of the most serious moment. It is no question of the stoker being a handy man, in order to carry out repairs and renewals under the supervision of a superior officer, but of the man in charge of any portion of machinery having the thorough knowledge of the nature and capabilities of the machinery and of surrounding circumstances to enable him to act in the moment of urgency, without hesitation and with a sound conviction that he is doing the proper thing and that his action can be supported with good and sound reasons. The question of the supply of properly qualified men to fill the posts of engineers and artificers not being adequate to ever growing needs of the Royal Navy is a matter also deserving of the most earnest attention by those in authority, as it strikes at the very foundation of the efficiency of a highly scientific weapon, for the reason that if you have not sufficient skilled men to work it, its advantages cannot be fully realised. There is no doubt that technical education is spreading very fast among our artisans and that we have a class of men ever increasing in numbers coming forward who are far in front of their predecessors and yet the inducements are not sufficient to permit the Royal Navy to take her share of these improved artisans. The First Lord of the Admiralty in his reply states the changes in question were the outcome of a most painstaking inquiry on the part of a body of experts in whom the late Board had the greatest confidence, and that the reduction had only taken place in the older ships, there being an actual increase of complement in the modern ships. This we are glad to note, but if the increase is effected by the raising of unskilled hands into the position formerly occupied by skilled hands, the complement may be increased but the efficiency decreased, the latter being the most important point to bear in mind. Although Lord Spencer gives the assurance in his reply that only those properly qualified have been promoted, we think a very dangerous precedent has been made, inasmuch as no definite standard can be fixed by the men to which they must work in order to

be certain of promotion. We are pleased to note that the ratings of chief engine-room artificers have been slightly increased in proportion to that of other artificers and also that the pay of chief and other stokers has been improved. The Admiralty anticipate that the manœuvres will afford valuable information on the question, but whatever result is obtained from them it cannot be said to have any great value as to what would take place in the time of war when the men are under considerable mental tension. Whatever may be the outcome of the negotiations, we think that it is extremely fortunate that such an able body of engineers should take upon themselves the important duty of safeguarding the efficiency of our Navy, which is one of the strongest factors of our national strength and stability.

On both sides of the Atlantic those in authority seem to be determined that whatever may be said from the point of view of Liverpool and Queenstown, there shall be no opportunity for those interested in the American Line to complain of a want of fair play. There was a suggestion a few weeks back that correspondence specially marked to go by the *Campania* was in fact sent by the *Paris*, and that thereby the correspondence so mis-sent, not only lost the chance of reply by the outgoing Cunarder, which would have landed the answer in New York within fourteen days of the original despatch, but as it did not reach the City of London till Monday morning, was falsely made to convey the impression to the addressee that in the case referred to Queenstown had not done any better than Southampton. Whether there was any truth in this allegation we do not know. And a further question may be asked, viz. :—Whether, if a few letters did go by the wrong boat, it would not be more likely to be due to a natural error on the part of the sorters? This is very possible, but the fact remains that the Queenstown people thought themselves hardly used. Now comes a more serious grievance and one that originates on this side. Some months ago a " special service " from Queenstown was started, and it was to be used whenever the inward packet landed its mails at such a time as to miss the ordinary service. The convenience of this was very great, and with it the advantage of Queenstown was by no means slight. This service, however, is to be discontinued on the ground of expense. Yet that expense seems slight. The *Southampton Times* the other day told us it was £2,000 every time the service was used. £2,000 must have been an error for £200. Even that is an exaggeration; £150 is nearer the mark. But if we regard the distance from Queenstown and the subsidy paid to the Southampton line by the United States Government we shall see that per mile run the mixed service (including and chiefly consisting of special trains) was not more highly paid than is the American line for its sea service, where it has receipts from passengers and freight to aid it. No sooner is this special service withheld than we find the *Majestic* and *Paris*—nearly equal boats—leaving New York the same day, 16th of August. The *Majestic* does not get the bulk of the mail—as perhaps is natural under the circumstances. But had she had the special service her mails might have reached London by noon on the 23rd, that is, before the *Paris* reached Southampton. As it was they were scarcely delivered in business hours. The South-Western never hesitates to give the American line as many specials as it can desire. Indeed the ordinary service of the South-Western does not justify the boast that Waterloo is always within 1¾ hours of Southampton. Whatever may be said the old route has a grievance, and at all events on the surface there is a slight appearance of too great anxiety to welcome the coming guest.

The coal strike or "war" as it is termed that is now raging in Great Britain cannot but have a considerable effect upon and inconvenience to the shipping trade. So large a proportion of the carrying trade of the world is now carried on by steam-power, that any stoppage of supplies of coal to the usual coaling stations must seriously embarrass the Mercantile Marine. There is no doubt that the supplies of Welsh and other steam coal to the coal stations abroad is at present almost at a stand-still. It is said that the coal quays at Cardiff from which is shipped weekly so enormous a quantity of Welsh coal, are at present a howling wilderness and the docks are full of empty vessels awaiting their coal freights, and further admissions of vessels are refused. Bad, however, as the outlook is, it must not be supposed that Great Britain has the monopoly of all the coal-fields of the world. it is a question merely of quality and price. Whilst the price of British coals is as low as it has been and the quality is undeniable as it always is, the British coal has held almost a monopoly at all coaling stations abroad. But there is any amount of Belgian coal to be had cheap enough, but of inferior quality to the British coal, and which is, however, sufficiently good for all steam purposes when better is not to be had. There are also enormous deposits of good coal in America, Natal, India, Japan, and Australia, already largely supplied to local markets, and which merely await a scarcity or rise in price in British coal to compete with it in foreign markets. Already agents are offering Belgian coal on the London coal ex-

change, though as yet the pressure of the strike has not been sufficient to open the British market to them. It is a pity that British coal miners and their leaders do not inform themselves more accurately as to the general condition of markets and the possibility of competition in supply from other countries, when they would probably be more cautious in knocking their heads against the bric wall of supply and demand, and never strike on a falling market. We are credibly informed that many of the large shipowners are now making arrangements to get supplies of coal from continental ports such as Dunkirk, Antwerp, and Amsterdam. It is reported that Teneriffe and the Canary Islands will ship coal from America if the strike lasts and probably find it cheaper. For Africa and the East, the coal-fields of Natal are likely to do good business with the Cape ports, which were formerly supplied with Welsh coal only. The Indian collieries are already feeling the benefit of the strike and a much larger demand for coal now exists there. For some time past many of the large steamship companies have been taking all their supplies at Calcutta, and now many steamers are employed taking Bengal coal to Ceylon and other Indian coaling stations and laying it down there. Singapore and China ports will increase their stock of Japanese and Australian coal; and it is therefore likely, that when the worst of the strike has been passed, the British miners may find that the want of supply of British coal has introduced new and formidable rival supplies in foreign markets.

ON THE PRESENT POSITION OF WATER-TUBE BOILERS AS APPLIED FOR MARINE PURPOSES.*

By J. T. Milton, Esq., Chief Engineer Surveyor to Lloyd's Registry of Shipping, Member of Council.

At the present time the boiler question is attracting considerable attention amongst marine engineers, who have by no means arrived at a unanimous conclusion as to the types of boilers which best satisfy the peculiar requirements of different classes of vessels. To see that this is so, we have only to look at the plans adopted in different vessels having presumably the same requirements, to find great divergency of practices. For instance, in the war-vessels of our own and foreign countries, we see large vessels, which may have to keep the sea for long periods, in some cases fitted with ordinary tubular boilers worked with the closed stokehold system of forced draught, and in others with water-tube boilers worked with natural draught; while in another case, a reference to our own Transactions will show that a combination of ordinary cylindrical and locomotive type boilers has been adopted. In smaller types of ships which may not be required to be continuously under steam, we find vessels having apparently similar requirements fitted, in some cases, with ordinary cylindrical boilers, in others, with the locomotive-marine type, while in some water-tube boilers of peculiarly light construction are used.

Turning to merchant vessels, we find some passenger steamers of great speed fitted with ordinary boilers working under natural draught, others employing different forms of forced draught with the same type of boilers, while in still other cases water-tube boilers are used. Again, while most cargo vessels are fitted with boilers working under natural draught, several are fitted with forms of forced or induced draught, some using only plain boiler tubes, while, on the other hand, "Serve" tubes are not uncommon.

In view of this divergency of practice it is thought that it would be interesting to draw attention to, and to put on record, what is being done at the present time with water-tube boilers, especially in view of the fact that, owing probably to prejudice arising from the failures several years ago of a few unsuccessful types of these boilers, their use in British vessels has till very recently been confined to a few torpedo boats, or to vessels of similar class. It is proposed, therefore, in this paper to give a statement of some cases in which water-tube boilers have been successfully used, and in which they may be fairly said to have passed out of the experimental stage, and also to give a short description of the various types of boilers employed.

It is well to bear in mind that the objects aimed at in designing boilers for different classes of vessels may be entirely different, and to remember that the success or otherwise of any design should be judged from the way in which it fulfils these special objects, and not from a point of view of general utility for all purposes. As an extreme instance, it is evident that a boiler which would give satisfactory results in a cargo vessel would not be of much service in a torpedo-boat.

The use of water-tube boilers, instead of those of the ordinary type, has generally arisen from the desire of obtaining some or other of the following advantages. The relative importance of these not always being the same has no doubt led to the various designs being adopted in different cases.

(1) The means of obtaining higher working pressures than are practical with ordinary boilers owing to the excessive thickness of plates which would be necessary both for the shell and also for the heating surfaces.

(2) Economy of maintenance due to the comparative ease with which in some designs every part of the boiler, both external and internal, can be examined and cleaned, and if necessary renewed, it being with some types possible to entirely reboiler a vessel without opening decks, &c.

(3) A decrease of space required and also of weight of boilers and accessories necessary for producing a given power, or an increase of power obtainable with a given weight and in a given space.

(4) It is also generally claimed for all classes of water-tube boilers that they are less liable than ordinary boilers to derangement or damage through accident or neglect; and also that, even in the case of rupture, the damage which would result would be much less than with ordinary boilers, owing to the much less quantity of water they contain.

There is one important point, viz., "durability," which is indirectly included in the Condition 2, as to which experience is at present deficient. Although in special cases ordinary boilers have been replaced within two or three years, it is well known that few have become worn out in less than ten or twelve years, when treated with ordinary care, while many cases are within our knowledge of such boilers being now in use after twenty years' service. It is obvious that no such record of service can yet be recorded with water-tube boilers in general, although lengthened experience has been obtained with some special kinds.

Turning to actual cases of the use of these boilers, we must frankly admit at the outset that we are indebted for our experience to the French engineers, who successfully used these boilers before they were placed in any British vessel. In the French Navy they are not looked upon as experimental, for, according to the "Carnet de l'Officier de Marine," edited by Mons. Léon Renard, it appears that the whole of the French war-vessels which are now being built, or which have been lately finished, are, or will be, furnished with water-tube boilers. Those in the larger vessels are either of the Belleville or the Lagrafel-D'Allest types, these being employed in about equal proportions, while in smaller and lighter vessels boilers of the Oriolle, Du Temple, Normand, Thornycroft, and similar types are used.

It appears that so long ago as 1879, the despatch vessel *Le Voltigeur* was fitted with Belleville boilers. She has since seen considerable sea service, and her boilers have given satisfaction. After two commissions of about three years each, her boilers were reported to have needed no repairs. We find also that the *Milan*, launched in 1885, and the *Alger* in 1889, have also been fitted with these boilers. In view of the present practice of the

* Read at the Summer Meetings, Cardiff, of the Thirty-fourth Session of the Institution of Naval Architects

French naval authorities it can only be concluded that their use has given satisfaction.

Turning to merchant vessels, so long ago as 1871 the s.s. *Isere*, of 287 tons, was fitted with Lagrafel boilers; in 1873 the s.s. *Blidah*, of 267 tons, and *Medeah* of 236 tons, were similarly fitted, and their boilers are still in these vessels. In 1874 the s.ss. *Paoli* and *Spahis* were fitted with this type of boiler, which were in use for seven and eleven years respectively, until the vessels were lost. The s.ss. *Colon*, *Cabile*, and *Caid* were also fitted with these boilers in 1874, 1875, and 1876, and although these vessels are now withdrawn from service, their boilers were in use for many years. The s.s. *Liban* of 1,332 tons, built in 1882, was refitted with the Lagrafel-D'Allest boilers in 1891, and the s.s. *Dom Pedro*, of 2,999 tons, was similarly refitted at about the same time. The former of these vessels is engaged in general trade, the latter is running regularly between Europe and South America.

In 1884 the then new steamer *Ortégal*, of 3,570 tons, belonging to the Messageries Maritimes Cie., was fitted with compound engines with cylinders of 36 in. and 64 in. by 42 in. stroke, and with Belleville boilers. The s.s. *Sindh* belonging to the same company was also reboilered with this type several years ago. The company's latest and largest vessels, the *Australien*, built in 1889, the *Polynésien*, in 1890, and the *Armand Behic* and *Ville de la Ciotat*, built in 1892, are each fitted with similar boilers. These last four vessels are each of about 6,500 tons, they are fitted with triple-expansion engines indicating regularly about 5,000 I.H.P. at sea, which gives them a mean speed on the round voyage of about 15½ knots.

The Oriolle boiler made by Mons. P. Oriolle, of Nantes, was fitted last year in the s.s. *Mitidjah*, a vessel of 1,160 tons, and has also been fitted in several smaller vessels. Experience with this boiler is not so great as with the types previously mentioned.

The Babcock and Wilcox boiler has been fitted in some small vessels, and recently a large boiler working at 200 lbs. pressure has been fitted in the British s.s. *Nero*, a vessel of 1,053 tons, owned by Messrs. T. Wilson & Sons, of Hull. Experience with this boiler will be watched for with great interest.

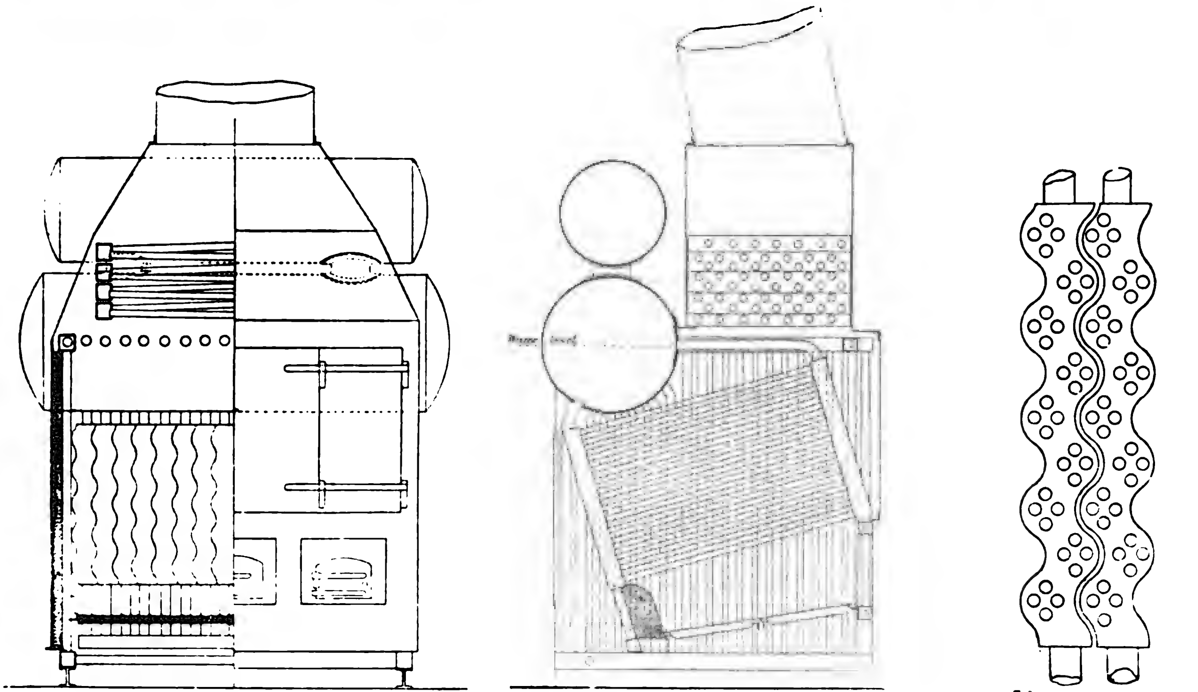
Turning our attention again to war-vessels, we find that in our own navy the Thornycroft and Yarrow boilers have given great satisfaction in torpedo vessels, and their comparative lightness in proportion to their evaporative power have enabled higher speeds to be obtained than could be realised with the older form of locomotive-marine boilers. The former type, also, is being fitted to H.M.S. *Speedy*, a torpedo cruiser of 4,500 I.H.P. It has been successfully fitted in some foreign war vessels of similar class, and both these types of boiler are to be used in the specially fast cruisers, whose speed of 27 knots recently stated by the First Lord of the Admiralty, could not possibly be realised except by the use of both engines and boilers which will give the maximum of power on the minimum of weight.

In the French Navy the Normand and Du Temple boilers are used for similar vessels.

The first type of boiler to which attention will be drawn is that of the Babcock & Wilcox Co., shown in Fig. 1, which represents that fitted in the s.s. *Nero*. The working pressure in this case is 200 lbs. per square inch, but it is evident that, so far as considerations of strength only are concerned, there need be no difficulty in constructing similar boilers to work at very much higher pressures. In this boiler there are two sets of tubulous heating surfaces, each possessing separate circulating systems. One of these is a modification of the well-known land boiler made by this firm, and consists of a number of pairs of "headers" of sinuous form, connected by bundles of tubes, having an inclination of about 1 in 4, placed immediately over the fire. The modification from the land boiler being that each tube of the latter is replaced by a set of four smaller tubes, the ends of each set of four being expanded through one tube-door. Above these sets of tubes, and partly outside of the casing, is a pair of receivers—the upper being a steam chest, and the lower being, in ordinary working, about half-full of water and half of steam. The circulation in this part of the boiler takes place from the lower receiver, down the back headers, upwards through the sloping tubes and the front headers, then through the connecting pipes into the receiver. The bottom of each of the back headers is connected to a settling chamber, to which the blow-off cock is attached.

The other circulating system consists mainly of a number of vertical tubes on both sides of the boilers, forming part of its casing. These tubes are connected at the bottom to two horizontal pipes of square section, and at their top ends they either enter directly into the lower receiver below the water-line, or are connected to two other horizontal pipes, which open into the receiver at about the water level.

The circulation takes place from the receiver, down the three



Enlarged view showing sinuous form of header and disposition of tubes

BABCOCK & WILCOX BOILER.

FIG 1

or four back tubes, along the bottom horizontal pipes, up the other vertical tubes into the receiver either direct or through the upper horizontal pipes. In the front of the boiler there are other tubes forming part of the framework of the boiler, which also are connected to this circulating system.

Above the boiler, in the base of the chimney, is placed a tubulous feed-heater consisting of five horizontal headers on one side, and four on the other, connected across from side to side by means of numerous pipes so arranged that the water, being delivered from the feed-pump into the bottom box on one side, passes through these pipes from side to side, and finally emerges from the upper box, being thence led to the boiler. The circulation in this heater is thus purely a mechanical or forced circulation depending on the working of the feed-pump. The heating surface of the heater is only about one-sixth of that of the boiler; and, as it is placed in the coolest part of the boiler, it is not expected that sufficient heat will be extracted by it to raise the water to the temperature of ebullition, so that no steam will be formed in it, but the whole of the evaporation will be effected in the boiler itself. In this particular boiler the tubes over the fire are 1¼ in. internal diameter and 7 ft. long; the vertical tubes at the sides are 3 in. diameter, spaced 5 in. from centre to centre, and about 9 ft. long; while the feed-heater tubes are 3 in. diameter and about 7 ft. 6 in. long.

The side casing consists of 2 in. of brickwork resting against the vertical tubes, then a sheet of ¼-in. asbestos, backed by wrought iron plates. The front and back of the boiler consist mainly of doors made to give access to the headers and to the numerous small tube doors. There are three firing doors, and the grate area may be made either continuous from side to side, or it may be divided by brick partitions into three grates, one for each door, according to the plan which may be found to give better control over the firing, &c.

A peculiarity in this boiler is that all the joints of the tubes with the headers, cross tubes, and receiver, are made with ordinary rolled or expanded joints, no screwed stay tubes being used. The makers contend that these joints, when properly made, give perfect tightness and sufficient structural strength to resist all strains likely to come upon them; while, by avoiding varying thickness of tubes in the same part of the boiler, they prevent any straining taking place due to expansion with varying temperatures. Even the square tubes are connected together by having round holes made at the adjoining parts, and round nipples expanded into both holes. In the event of accident or mismanagement of the boiler occurring, such as shortness of water, overheating through deposits, &c., the makers consider that the loosening of a few only of the tubes would result, and that the holding power of the remainder would be much more than sufficient to prevent any general dislocation of the boiler.

To give access to the tube ends for the purpose of expanding them there must necessarily be numerous holes which have to be closed by special doors. In this boiler these doors are placed outside, not inside, as is usual in ordinary boilers, so that the pressure tends to force them off. They are made with faced joints, metal to metal, no jointing of any kind being used. The nut of the holding bolt is also faced on to the door, and is close ended. The plug or dog placed inside the boiler is made in one piece with the bolt, and is so formed that, in the event of the breakage of a bolt and its door falling off, a slight leakage only will result, and not a rush of steam, water, &c.

The importance of such a detail as this will be appreciated when it is considered that there are several hundreds of such doors in an ordinary sized boiler.

The Lagrafel-D'Allest boiler which is shown in Fig. 2 is made by the Forges et Chantiers de la Méditerranée, at Marseilles, and by the Fraissinet Co., of the same city. It possesses a certain resemblance to the internal part of the Babcock & Wilc boiler. The numerous sinuous headers of the latter are, however, replaced by water chambers, those of the front and bac each forming only one water space. These chambers or water spaces are formed of plates, retained in parallel positions, about 5 in. apart, by means of numerous screw stays. They are closed at the bottom and sides, but they open at their upper portions into a cylindrical steam chest, which is nearly horizontal, sloping a little towards the back of the boiler. The chambers extend down to about the level of the fire grate. They are connected by a number of water tubes placed above the fire, these tubes forming the main portion of the heating surface. A few tubes are also fitted at the sides of the fire, in order to protect the sides of the casing.

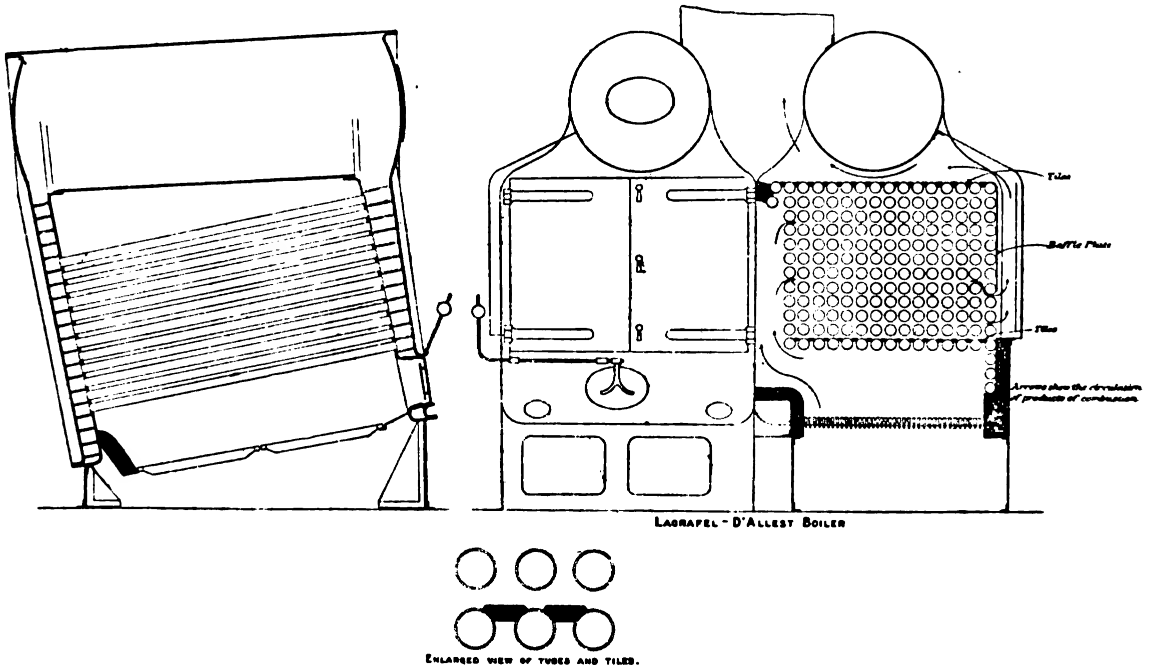


FIG. 2

In the manufacture of the boiler both plates of the chambers have to be pierced with as many holes as there are tubes, those in the outer plates being slightly larger in diameter than the tubes. The tubes are secured to the inner plates by means of expanded joints, access for this purpose being obtained through the holes in the outer plate, in the same manner as in the Babcock & Wilcox boiler; the latter holes are closed by specially constructed doors, which in this case are placed *inside* the boiler' each being secured by a bolt and cross-bar, the joint being made by means of a thin asbestos washer and a ring of thin copper wire

It should be noted that there are no stay tubes in this boiler. The water chambers are each connected to the horizontal steam chest at their upper portions, and at this part, therefore, do not need such stays. At the lower parts the necessary strength to resist separating the slabs is obtained by the friction of the tube joints, which are all expanded or rolled joints. The tubes generally employed are about 2¾ in. outside diameter, ⅛ in. thick, and are pitched about 4 in. apart from centre to centre. "Serve" tubes are recommended by the makers for the lower row of tubes.

The working water-level is a little above the bottom of the receiver, and the circulation of the water and steam is such that the water supply enters each tube at its lower end from the back water space, passes along the tube, where part of it is vaporised, the mixture of steam and water escaping into the other water chamber and rising direct into the receiver without having to pass through the upper tubes, as in the Belleville boiler. The water so carried over traverses the bottom of the steam receiver and passes down the other water chamber, where the process is repeated.

The feature distinguishing this boiler from all others is the arrangement made for the circulation of the products of combustion amongst the tubes. The boilers are usually arranged in pairs, each part having its own feeding and water circulation, independent of the other; but a combustion chamber is common to the fires of both parts, being arranged between the two nests of tubes.

The tubes are placed mainly over the fire, the bottom row being at a height of about 2 ft. above the grate bars. Over the bottom row of tubes and resting on them, preventing the passage of the gases between the tubes, are placed a number of specially shaped tiles, and a similar set are fitted upon the top row. Baffle plates are fitted to cover the spaces between the tubes for about the upper two-thirds of their depth at the sides remote from the combustion chamber. These arrangements are shown in Fig. 2, the arrows showing the direction which the products of combustion are compelled to take. They pass under the lower row of tubes into the combustion chamber, thence they proceed sideways between the tubes, emerging at the lower edge of the side of the nest of tubes, whence they proceed under the steam-chests on their way to the chimney.

In the Lagrafel, which was the older form of this boiler, the products of combustion passed directly from the fire up amongst the tubes, as is now done in some other forms of water-tube boiler. The reason for altering the design was owing to its being considered that the gases immediately arising from the fire have not been properly burned, and that by passing them directly amongst the tubes they become cooled below the critical temperature at which union between the gases and the oxygen of the air takes place; so that imperfect combustion and loss of economy results. If this is so in practice, most of the other types of water-tube boiler must be inefficient from this cause.

The interior of the tubes and water chambers can be readily examined or cleaned through the numerous small doors, and the removal of any tube in case of necessity can be made in a short time, the tube being either replaced or the holes plugged.

The Oriolle boiler, shown in Fig. 3, made by Mons. P. Oriolle, of Nantes, bears some resemblance to the Lagrafel boiler, being constructed of two water chambers connected by a number of tubes. Only one of these chambers, however, is connected with the steam receiver, the connection being made by means of a pipe. The tubes are placed directly over the fire, a few, however, being placed at the side of the fire, as in the Lagrafel-D'Allest boiler. The tubes are placed in diagonal rows, so that one tube is immediately over the space between the two below it. The products of combustion pass from the fire directly up amongst the tubes, and this arrangement of tubes produces a more efficient action of the hot gases than would result if the tubes were arranged in rows vertically over one another. It will be seen that in the arrangement for the circulation of the furnace gases this boiler is similar to the older form of Lagrafel boiler.

The working water-level is some distance below the upper rows of tubes. The circulation takes place within the boiler itself, being upwards along the lower rows of tubes, into the front water chamber, back along the rows of tubes nearest the water-level, down the back chamber, then through the tubes again, and so on. The tubes used are about 2 in. in diameter, and it is stated that the circulation is so rapid that no deposit takes place in them, even if impure water is used.

It will be noticed that several of the tubes are above the work-

	Lagrafel-D'Allest Boilers.						Lagrafel Boilers.		
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7.	No. ..	No. 9
Duration of Trial	6 hrs.	6 hrs. 45 mins.	6 hrs.	6 hrs.	3 hrs.	3 hrs.	6 hrs.	3 hrs.	3 hrs.
Weight of Cardiff Coal burned during the Trial	1,008 kilos	1,430 kilos	1,512 kilos	1,800 kilos	1,224 kilos	1,512 kilos	1,512 kilos	756 kilos	1,008 kilos
Ditto, per hour	168 ,,	211·8 ,,	252 ,,	300 ,,	408 ,,	504 ,,	252 ,,	252 ,,	336 ,,
Ditto, per square metre of Grate per hour	50·45 ,,	74 ,,	75·67 ,,	75 ,,	122·5 ,,	151 35 ,,	75·7 ,,	75·7 ,,	100·9 ,,
Weight of Ashes, &c ...	80 ,,	121·5 ,,	233 ,,	153 ,,	104 ,,	128·7 ,,	—	—	—
Water evaporated during the Trial	10,760 litres	13,700 litres	13,970 litres	16,150 litres	9,820 litres	13,230 litres	10,170 litres	4,110 litres	6,580 litres
Ditto, per hour	1,793 ,,	2,029·6 ,,	2,328·3 ,,	2,691·6 ,,	3,273·3 ,,	4,410 ,,	1,695 ,,	1,370 ,,	2,193·3 ,,
Ditto, per square metre of Heating Surface ..	17·93 ,,	20·29 ,,	23·28 ,,	26·91 ,,	32·73 ,,	44·1 ,,	16·95 ,,	13·7 ,,	21·9 ,,
Ditto, per kilo of Coal ...	10·67 ,,	9·58 ,,	9·23 ,,	8·97 ,,	8·02 ,,	8·75 ,,	6·72 ,,	5·43 ,,	6·526 ,,
Temperature of Feed ..	25° C. = 77° F.	25° C. = 77° F.	21°·5 C = 70°·7 F.	27° C. = 80°·6 F.	20°·5 C. = 68°·9 F.	21° C. = 69°·8 F.	22° C. = 71°·6 F.	22°·5 C. = 72°·5 F.	26° C. = 78°·4 F.
Ditto of Evaporation ...	148° C. = 298° F.	148° C. = 298° F.	148° C. = 298° F.	148° C. = 298° F.	148° C. = 298° F.	148° C. = 298° F.	148° C. = 298° F.	148° C. = 298° F.	148° C. = 298° F.
Evaporation from and at 212°	12·43	11·14	10·8	10·4	9·4	10·24	77·3	6·34	7·62

ing water-level, and when working must only contain steam which therefore must become, to some extent, superheated. It is probable that the surfaces of these tubes having only steam on one side of them, will prove less efficient for absorbing the heat from the furnace gases than the similar furnaces in other boilers which have water in contact with them, and, further, these tubes may be expected to waste much more rapidly than other parts of the boiler.

The Belleville boiler (shown in Fig. 4) consists of a series of sets of tubes placed side by side over the fire, and enclosed in non-conducting casings. Each set of tubes, called by the maker "an element," is constructed in the form of a flattened spiral, and consists of a number of straight tubes connected at the ends by means of screwed joints to junction boxes made of malleable cast iron. The junction boxes of each element are placed vertically over one another, and are so constructed that the upper end of one tube is at the same level as the lower end of the next tube in the spiral. The junction boxes at the back end of the elements are close ended, but those of the front end have holes in them to permit of the inspection of the inside of the tubes, these holes being closed by specially constructed doors. The examination of the interior of the boiler is made by means of an electric light fixed to the end of a rod which can be inserted in any tube. The tubes used in boilers for war-vessels are about 3 in. diameter, while those for merchant vessels are generally about 5 in. diameter. The thickness of the tubes in the latter case is about ¼ in. except those to bottom rows, which are made about ⅜ in.

The tubes are all slightly inclined to the horizontal, the lower box of each element is connected by means of a bolted joint to a horizontal cross tube at the front of the boiler called a feed-collecting tube. Each element is connected also at its upper part by a bolted joint to the lower part of the horizontal steam chest or receiver, which latter is outside the boiler casing. An external pipe connects the bottom of the steam chest with a separating chamber, which again is connected with the horizontal feed-collecting tube. The boiler feed, as delivered by the feed pump, enters the steam chest at the end opposite to that to which the circulating pipe is attached. The working water-level in the boiler is a little above the bottom of the steam chest. The circulation takes place by each element receiving a supply of water from the horizontal feed collector into its bottom tube. This water is partly evaporated in the lower tube, and passes partly as steam and partly as water through the back junction box into the tube above it, where a further portion is evaporated, and so on. Each tube therefore has to convey all the steam made in those tubes of the same element which are below it as well as that formed within itself. A mixture of steam and water is thus continuously discharged from each element into the receiver. The water so circulated mixed with the fresh feed water passes along the receiver bottom through the external circulating pipe into the separating chamber, and thence into the horizontal feed collector to be again circulated through the elements.

'll be seen that the tubes nearest the fire, and which there- exposed to most heat, contain relatively more water and less steam than those higher up in the boiler. Also, as the circulation depends upon the greater density of the water unmixed with steam in the external circulating pipe as compared with that of the mixture of steam and water in the elements, it follows that the greater is the average quantity of steam as compared with the water in the elements, the more rapid will be the circulation. The fact, therefore, that the whole of the steam formed in the lower tubes has to pass through the upper ones before being delivered into the steam chest, will increase the circulation beyond that which would result if each tube discharged its steam direct into the receiver, as is the case with the boilers previously described. On the other hand, it will be noticed that the water has to reverse its direction of motion each time it passes out of one tube into another, and this, no doubt, has a retarding effect on its velocity.

The use of the separating chamber is peculiar to this boiler, and, together with the method of feeding, is the outcome of considerable experience. Marine engineers who are familiar with ordinary boilers, fed with water from surface condensers, know how detrimental are the deposits which accumulate on the heating surfaces from the presence of grease and small quantities of sea-water in the feed, and some anxiety must be felt on this account in all vessels engaged on long voyages, necessitating the boilers being under steam for very long periods, even when the minimum amount of grease is used for the cylinders, piston rods, &c., and the feed make-up is provided by an evaporator. A slight leak in the condenser, for instance, will contaminate the feed in spite of an evaporator.

Pair of Oriolle boilers as fitted on torpedo boats

Elevation and longitudinal section

Transverse Section

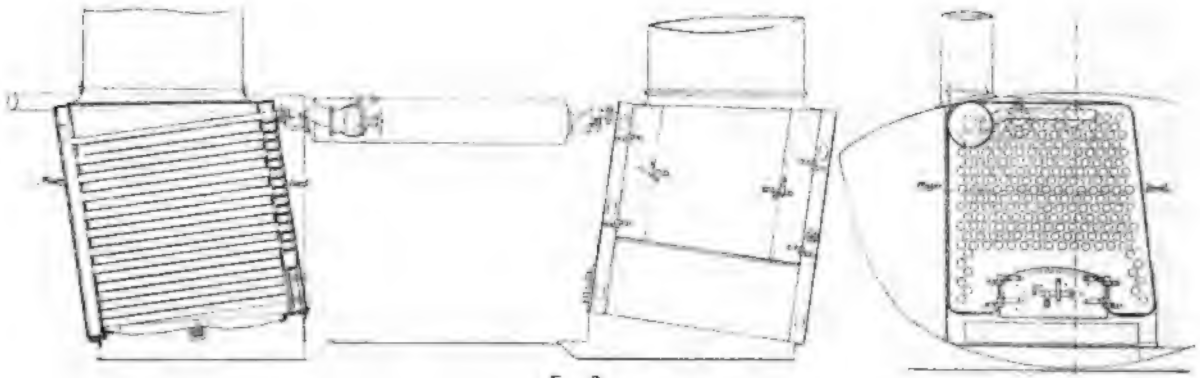


FIG. 3

In working this boiler the feed water is treated with a small quantity of lime in very dilute solution. It is delivered from the feed pump into the receiver at the end remote from the external circulating tube: it thus has to pass along the whole length of the bottom of the receiver, where it becomes mingled with the mixture of steam and water issuing from the elements. Its temperature must therefore be raised to that of ebullition before it enters the circulating pipe. At this temperature all the lime salts which are contained in the small quantity of sea-water which may be mixed with the feed, as well as the lime in solution, with which the feed is purposely treated, separate out in a solid but non-crystallisable form, which, being in an extremely fine state of division, is stated to become mixed with the oil particles which may be in the feed water, and to form a kind of mud, which separates and falls to the bottom of the separating chamber, owing to the water being comparatively quiescent at that part. The effluent feed water is thus purified before it enters the parts of the boiler comprising the heating surface, which therefore do not become encrusted. Experience shows that this actually takes place to a considerable extent, there being practically no deposit on the heating surfaces, even when sea-water make-up is used, while a white muddy deposit is found in the separating chamber.

It should be mentioned that in working the Lagrafel-D'Allest boiler the feed water is similarly treated with lime, an amount of about 4 lbs. per 24 hours per 1,000 I.H.P. being used, an arrangement being adopted whereby this small quantity can be regularly

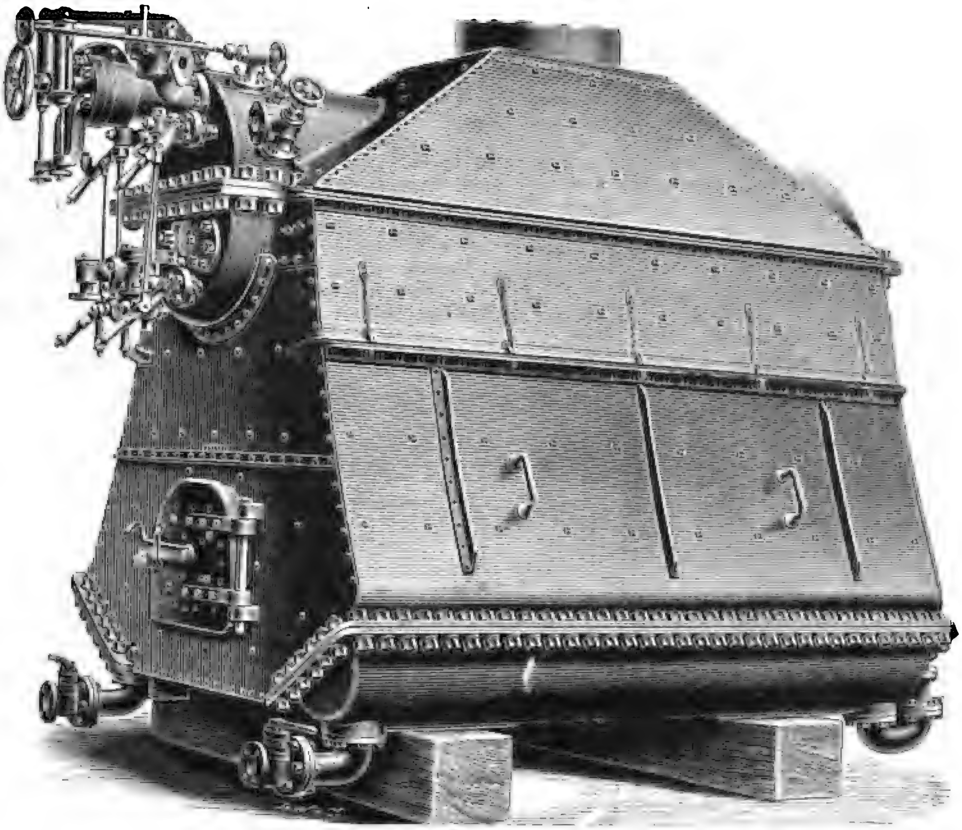


FIG. 8.

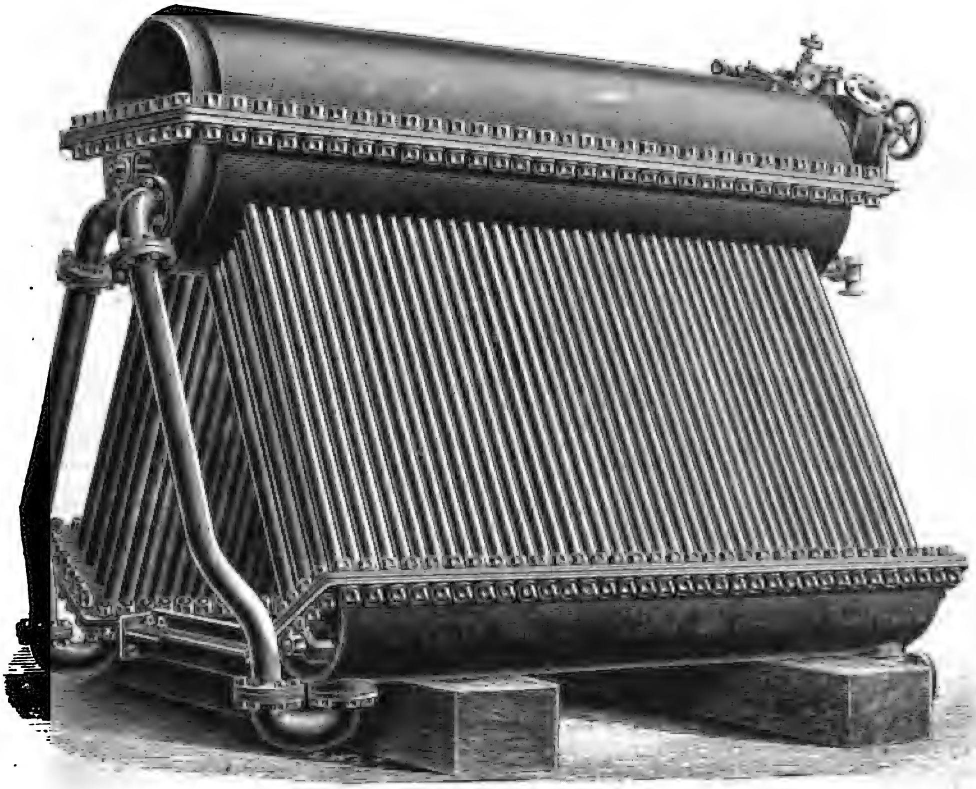


FIG. 9.

YARROW'S TUBULOUS BOILER (See page 224).

and continuously added to the feed; but in this boiler the separation cannot take place before the entry of the feed amongst the heating surfaces. The deposit takes place mostly in the lower part of the back chamber where the water is quiescent.

It is to be noted that in the Belleville boiler the junctions throughout are made with either bolted or screwed joints, no expanded joints being used. The tubes are simply screwed into the back junction boxes, the joint being secured with a thin checknut. The front junction boxes are fitted with screwed nipples, over which and over the front end of the tube a socket or collar is screwed, the joint being also backed up by a checknut. At this end of the tubes, therefore, a double thickness of metal is exposed between the fire and the water. What will appear as a

BELLEVILLE BOILER

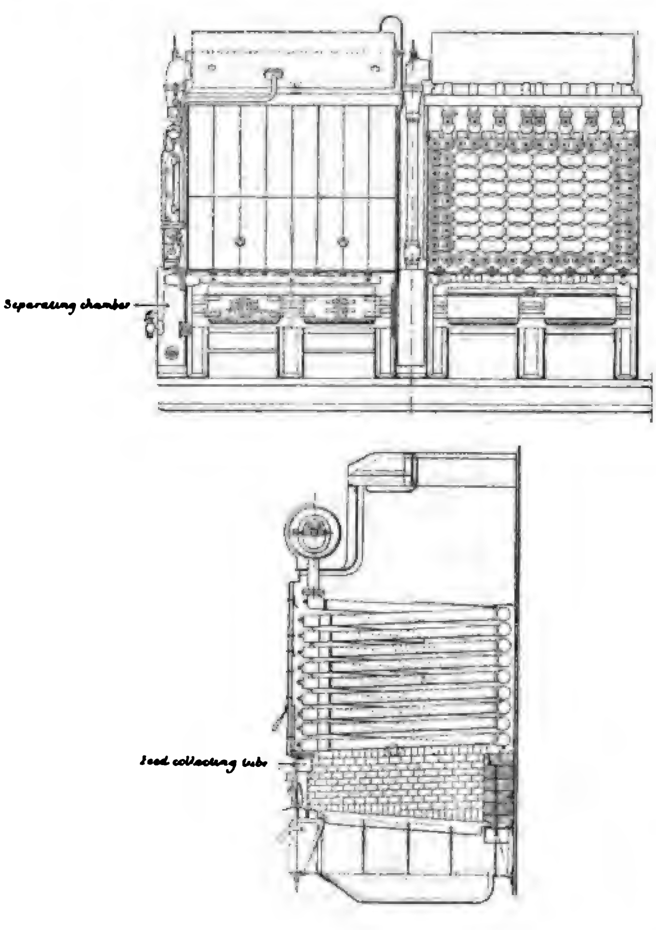


FIG 4

novelty to English engineers is the use of malleable cast iron for the junction boxes, which are exposed to the same pressure as the rest of the boiler, and also to a considerable amount of heat.

It has been stated that the internal surfaces of the tubes may be examined from the front ends, and they may also be cleaned if necessary. The external surfaces are cleaned by means of a steam jet inserted in the spaces between the junction boxes.

The ease with which repairs to these boilers may be effected is shown from the fact that a boiler may be shut off from the others, emptied, any element disconnected by breaking the upper and lower bolted joints, brought out into the stokehold, and any one tube taken out by cutting through the screwed socket connecting it to the front junction box and unscrewing it from the back box; a new tube and socket can then be inserted, the element replaced, the boiler refilled, and steam again raised in about six hours, the whole work being done by one skilled engineer, assisted by firemen.

It will be noticed that the boilers previously described are composed of straight tubes of comparatively large diameter, the designs admitting of more or less perfect inspection and cleaning of the whole of the internal surfaces. Those remaining to be described are in marked contrast, being composed of small tubes in proportion to their length, and in only one out of the four are the tubes straight, in the other three neither inspection nor cleaning of the internal surfaces being practicable.

The Thornycroft boiler was fully described by Mr. Thornycroft at the spring meeting of this Institution of 1889. Fig. 5, representing the boiler, is reproduced from the Transactions of that year. It consists mainly of three horizontal cylinders, the upper one being the steam chest. The upper is connected to the two lower chests by two circulating tubes of large size external to the boiler casing, and by a multitude of small tubes bent into tortuous curves within the casing, these small tubes forming the heating surfaces. In the external rows these tubes are placed

AS APPLIED FOR MARINE PURPOSES 15

APPENDIX.

RESULTS OF EXPERIMENTS MADE AT MARSEILLES WITH LAGRAFEL AND LAGRAFEL-D'ALLEST BOILERS, UNDER THE DIRECTION OF MONS. TATON, ENGINEER OF THE FRENCH NAVY.

PARTICULARS OF BOILERS

LAGRAFEL-D'ALLEST BOILERS.

	Trials Nos. 1, 2, 3, and 4.	Trial No. 5.	Trial No. 6.
Grate Surface	3·3 sq. metres = 35·9 sq. feet	2·85 sq. metres = 30·5 sq. feet	4 sq. metres = 43 sq. feet
Proportion of Grate to Heating Surface	[illegible]	[illegible]	[illegible]
Tubular Surface	96·7 sq. metres = 1,040 sq. feet		
Plate Heating Surface ...	3·3 „ = 36 „		
Total Heating Surface ...	100 „ = 1,076 „		
Section of Chimney	·95 „ = 10·2 „		

LAGRAFEL BOILER.

Grate Surface	3·3 sq. metres = 35·9 sq. feet
Tubular Surface	96·7 „ = 1,040 „
Plate Heating Surface	3·3 „ = 36 „
Total Heating Surface	100 „ = 1,076 „
Section of Chimney	·95 „ = 10·2 „
Proportion of Grate to Heating Surface	[illegible]

Trials Nos. 1, 2, 3, and 4 made with the Lagrafel-D'Allest boilers, and Nos. 7, 8, and 9 with the Lagrafel boilers, were made with natural draught. Nos. 5 and 6, with Lagrafel-D'Allest boilers, with forced draught.

side by side in contact in order to protect the casing, while the inner rows are similarly placed side by side to form a continuous arch over the fire, and to compel the products of combustion to pass uniformly around the other tubes forming the heating surfaces. A peculiarity of this boiler is that all the tubes enter the upper half of the steam chest. The tubes are 1 in. and 1¼ in. in diameter. The working water-level is such as to permit the upper chest to contain a considerable quantity of water. The tubes being so small in diameter, the evaporation in them renders the density of the mixture of water and steam they contain so much less than that of the water, which is without admixture of steam, in the external circulating pipe as to cause a rapid circulation even through the upper or highest tubes. The water brought over by the tubes is separated from the steam by means of the baffle plates.

The products of combustion enter the lower parts of the spaces between the tubes and traverse nearly the whole length of the tubes in the direction of their length. It is difficult to see how the outside of the tubes can be freed from soot and the lower parts of the spaces between the tubes from an accumulation of ashes and dust. These points, combined with the impossibility of examining them internally and the difficulty of localising any tube which may become defective, and of renewing it when dis-

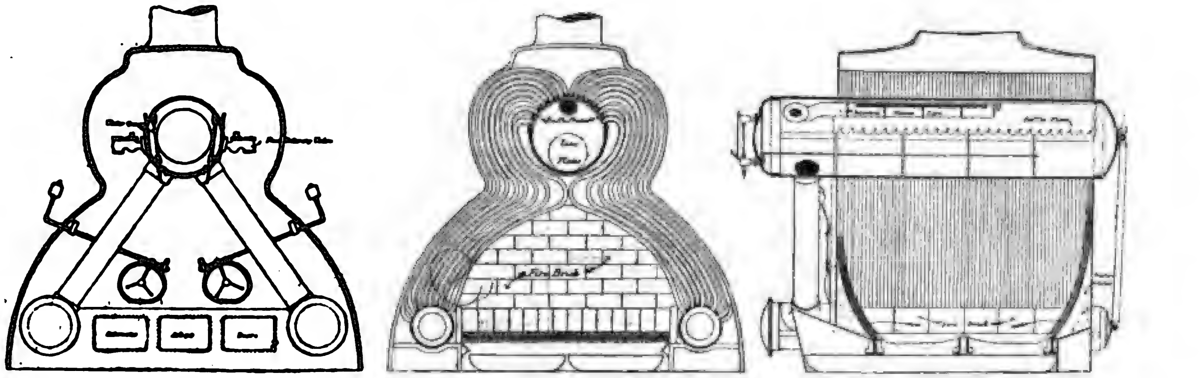
covered, will, it is thought, prevent the introduction of this boiler for use in ocean-going steamers, but the results obtained by it, as regards its evaporative power in proportion to its weight, combined with its evaporative economy in proportion to the fuel consumed, show how eminently suitable it is for purposes where enormous power is of more consequence than very prolonged efficiency. Particulars of these results may be found in the references quoted, and also in Mr. Thornycroft's paper read at the Institute of Civil Engineers.

A modified form of this boiler, containing two fire grates, has been proposed by Mr. Thornycroft, in which there are one upper, or steam chamber, and three lower water chambers, the centre and largest of these being between the two fire grates.

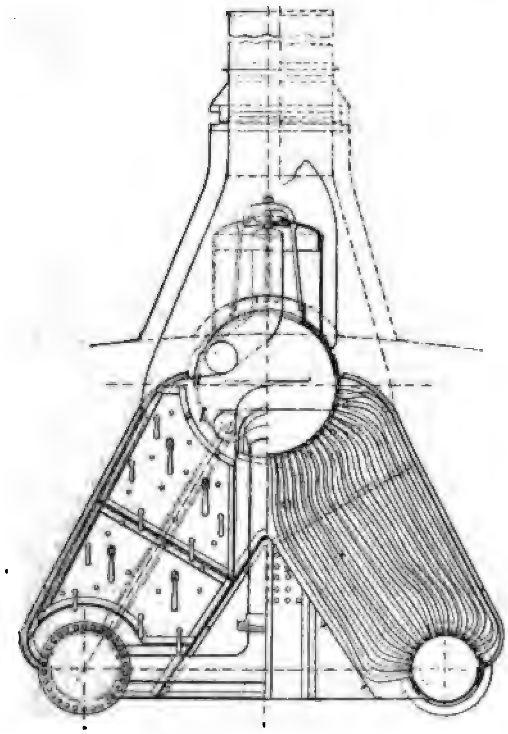
Fig. 6 represents a cross section of the Normand boiler, which is seen to present some of the features of the Thornycroft boiler. There are the same three horizontal cylinder receivers, the upper being a steam chest and the two lower being water chambers, the main point of difference being that all the heating tubes are connected to the lower half of the steam chest instead of to the upper half. There are in this boiler external circulating tubes placed at both ends instead of at one end only as in the Thornycroft boiler. A reference to the sketch will show that while the shapes of the heating tubes are different from those in the other boilers, considerable trouble appears to have been taken to prevent any of them being straight.

Fig. 7 shows a cross section, &c., of the Du Temple boiler, as fitted in torpedo-boats. This also bears some resemblance to the two former boilers, but there are some important differences Like the Normand boiler, there are two external circulating tubes at each end connecting the upper with the lower chambers, and the heating tubes also enter the upper chamber along the bottom half. These heating tubes are of small diameter, and of the sig-

THE "THORNYCROFT" WATER TUBE BOILER.

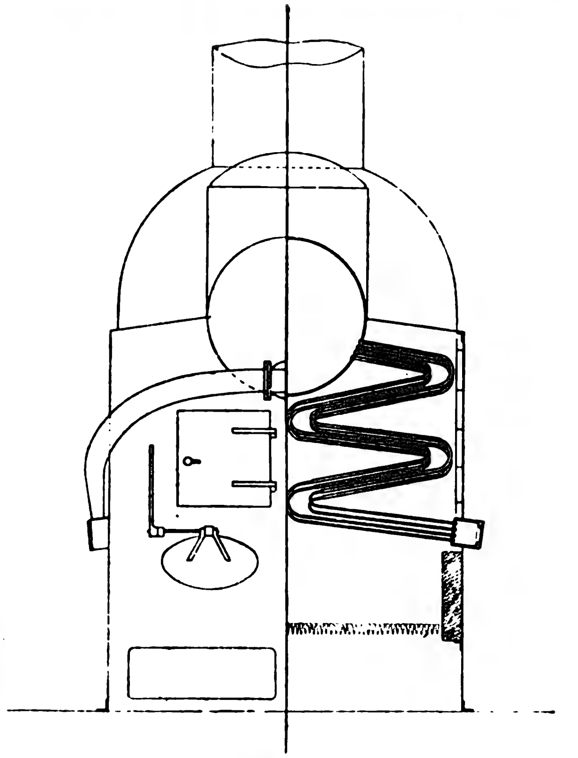


— Fig. 5 —



NORMAND BOILER

Fig 6



DU TEMPLE BOILER

Fig 7

zag shape shown, and have the peculiarity of having their lower portions made of reduced diameter. The water chambers are made of comparatively small cross section, but they are fitted throughout their length with doors, which give access to their interiors. The fire grate is situated between brick sides, so that the whole of the length of the heating tubes is above the level of the fire. The products of combustion rise straight up from the fire between the tubes, so that the direction of motion of the gases is across the length of the tubes instead of along it, as in the Thornycroft boiler.

The Yarrow boiler is represented by Figs. 8 and 9. In this boiler also there are one upper and two lower horizontal chambers, connected by two circulating tubes external to the casing, and by a number of small heating tubes which, in this case, are straight. In the smaller boilers the upper chamber is made in two halves, bolted together, to enable the upper half to be removed. The lower chambers are each made with a flat side, forming a tube plate, the lower portions being of semi-cylindrical form, bolted

RESULTS OF EXPERIMENTS MADE WITH LAGRAFEL-D'ALLEST BOILERS UNDER THE DIRECTION OF FRENCH NAVAL OFFICERS, AND OF REPRESENTATIVES OF THE FORGES ET CHANTIERS DE LA MÉDITERRANÉE.

	Trial No. 1.	Trial No. 2	Trial No. 3
Date of tr	June 29, 1892.	July 2, 1892	July 6, 1892
Duration of trial	6 hours.	1[illegible] hours.	6 hours total.
Weight of Cardiff coal burned during the trial	4,500 kilos.	5,400 kilos	2,700 kilos during 1st 3 hours 3,375 .. .. 2nd ..
Do. per square metre of grate per hour ...	100 kilos	60 kilos	120 .. .. 1st .. 150 .. .. 2nd ..
Water evaporated during the trial ...	44,125 litres.	54,370 litres	25,654 litres .. 1st .. 31,169 .. .. 2nd ..
Do. per hour	7,354 litres	4,530 litres.	8,551 .. .. 1st .. 10,389 .. .. 2nd ..
Do per square metre of heating surface. ...	29 41 litres.	18·12 litres.	34·2 .. .. 1st .. 41·55 .. .. 2nd ..
Do. per kilo. of coal ..	9 80 litres.	10·068 litres	9·501 .. .. 1st .. 9·235 .. .. 2nd ..
Temperature of feed	48·75°C =119·75°F.	51° C = 123·8° F.	52° C. = 125·6° F. mean during both periods
Do of evaporation	194° C =381° F.	194° C = 381° F	194° C. = 381° F.
Evaporation from and at 212 F	11 25	11·51	10·85 during 1st 3 hours 10 54 .. 2nd ..

RESULTS OF SIMILAR TRIALS ON ANOTHER VESSEL.

Date of trials	Feb 12, 1890	Feb. 19, 1890.	Feb. 25, 1890.
Duration of trials	3 hours	3 hours.	8 hours.
Coal burned per sq. metre of grate surface per hour	223 4 kilos	175 kilos	75 kilos
Water evaporated per kilo. of coal	8 24 kilos	9·07 kilos	9·43 kilos.

RESULTS OF OFFICIAL TRIALS OF S.S. "LIBAN," MADE IN OCTOBER, 1890, WITH SPEED OF ENGINES VARIED IN ACCORDANCE WITH THE POWERS DEVELOPED

Duration of trials	8 hours	24 hours	8 hours	8¼ hours.
I.H.P. per square metre of grate (French measures)	66·1	86·2	182·9	147
Do. per square foot of grate (English measures)	5·06	7·9	12·1	13·45
Coal per I.H.P. (French) per hour	·614 kilos	667 kilos	732 kilos	·808 kilos.
Do per I.H.P. (English) .	1·37 lbs	1·49 lbs.	1·63 lbs.	1·8 lbs.

to the tube plates. By removing these parts the tubes are accessible from both ends, and, being straight, they may be examined and cleaned as well as their small diameter will permit. The outside of all the tubes also may be cleaned from soot, &c., the casing being made portable (as shown in Fig. 8) to permit of this. The fire grate is placed between the lower chambers, and the products of combustion pass between the tubes on their way to the chimney, their direction of motion being across the length of the tubes, as is the case in the Du Temple boiler.

In both the Yarrow and Thornycroft boilers the heating tubes are made of seamless steel. In some cases they have been galvanised. Seamless tubes are used, not so much on account of their strength being greater than that of lap-welded tubes of the same diameter and thickness, as to ensure freedom from small local defects in the weld, which, although not materially impairing the strength, may, by reason of the less thickness of sound metal they present, permit a small amount of corrosion to perforate the tube, in which, of course, even a minute pinhole, permitting the escape of steam or water, will necessitate the removal of the tube.

A combination of water-tube and ordinary smoke-tube boiler is now being tried by Messrs. Anderson & Lyall, of Glasgow. In this boiler the water tubes are placed over the fire, and receive the fullest heat of the products of combustion, which, after entering a combustion chamber, pass through the smoke tubes which are surrounded by water. In this form of boiler the ordinary furnace flue is dispensed with, and the casing of the part of the boiler containing the tubes is of considerably smaller diameter than the shell of an ordinary boiler containing the same heating surfaces, so that thinner plates and less weight both of boiler and water are needed. The makers have at present only made one boiler on this plan, and they are now engaged in making experiments with it to determine the most advantageous proportions for the various parts with the view of adopting the plan for marine purposes.

The experiences given in the paper as to the time during which some of the boilers have been in use, and the fact that their use is extending amongst those most familiar with them, show that so far as safety is concerned water-tube boilers can be made satisfactory. The point upon which many will wish for information is that of their economy as steam raisers on ordinary service. Unfortunately I am unable to supply this information.

In the paper to which reference has been made, however, some information will be found as to the efficiency of the Thornycroft boiler, and I am indebted to Mons. D'Allest for some information given in the Appendix as to the results of trials made upon the Lagrafel and Lagrafel-D'Allest boilers by Mons. Taton, a French Naval engineer.

In each case of these trials the coal used was carefully weighed, the firing being regulated to burn 50, 75, 125, and 150 kilos per hour per square metre of the grate area. The feed water was measured, and it was noted that there was practically no water (priming) carried off with the escaping steam. The results with the modern form of the boiler show a very good efficiency, and if such results can be obtained in ordinary working with water-tube boilers, the higher pressures they will admit of should lead to more economical results being obtained.

THE DOCKS OF GLASGOW.

SINCE we last referred to these, in our issue of October 1st, 1890, great progress has been made with the construction of the Cessnock Dock, the original Act for which was passed by Parliament in 1883, but its construction was not pushed forward in consequence of the commercial depression which immediately followed.

The greatest physical difficulty in the designing of the Dock was the existence of the main road connecting Glasgow and Govan, locally called the Govan Road, which ran nearly parallel with, and averaged about 117 yards distant from the south side of the Clyde.

By the design of 1883, this road was arranged to remain very much in its original position and to save detention to the heavy traffic passing along, it was bifurcated near the entrance of the Dock from the river, and carried over the connecting basin by two swing bridges, only one of which was to be open at a time.

The delay in proceeding with the execution of the work enabled the design to be carefully reconsidered, with the result that the Clyde Trustees laid before, and successfully carried through Parliament, in 1890, nowithstanding the strenuous opposition of the Commissioners of the Burgh of Govan, who in 1883 objected to the bifurcated road and swing bridges, the scheme now in course of construction, whereby the Govan Road without swing bridges, which the Govan Commissioners contended for in 1883, was carried right round the Dock, a canting basin 10¾ acres in extent provided immediately inside the entrance, which will enable vessels up to 650 ft. in length being turned round with the greatest facility, and three berthing basins supplied, each entering from the canting basin.

By the original design, two Graving Docks were provided in the centre one of these berthing basins, thereby reducing the quayage of the Dock to a very considerable extent. These two Graving Docks were omitted from the design of 1889, and a Graving Dock provided immediately south of the two Graving Docks already in existence there. The design and general dimensions of this Graving Dock have had the approval of no less an authority than Mr. White, Director of Naval Construction to the Admiralty.

The opposition of the Govan Commissioners to the Act of 1890 necessitated the Trustees going to Parliament in 1891 for a slight modification of the diversion of the Govan Road, and by arrangement between parties, the opposition of the Commissioners was withdrawn, and the Bill passed unopposed.

The construction of the road diversion 1,565 yards in length by 60 ft. in width, the roadway being 35 ft. and the footpath on each side 12½ ft. in width, was along with an extensive system of new main sewers rendered necessary by the construction of the Dock, commenced in January, 1891, and the sewers were completed on 31st October, 1891, and the road opened for traffic on 1st February, 1892. The cost of the road diversion, which included two lines of rails for the Vale of Clyde Tramways, was £29,954, and for the sewers, £8,021.

The entrance walls of the Dock being common to whatever design was adopted were commenced on January 18th, 1887, and completed on September 15th, 1888, and the North Quay wall of north basin thereafter commenced and continued for 1,444 lineal ft., where its further progress was stopped by the roadway leading from the Govan Road to the large steam crane on Plantation Quay, which road could not be shut up until a new road further east was provided. The construction of the South Quay wall of north basin followed, the dredging out of basin succeeded in due course, and in October, 1892, the first vessel discharged its cargo therein.

The construction of a two-storey shed 1,378 ft. in length by 70 ft. wide on North Quay wall of north basin was commenced in July, 1891, and was completed in June, 1893, and the construction of the remaining 232 ft. 1 in. of north wall of basin, and of the end wall of same, and the shed for the remainder of the North Quay are now in hand. In March last a contract was entered into for the construction on the South Quay wall of north basin of a similar two-storey shed 1,156½ ft. long by 75 ft. wide, and good progress is being made with same.

The end wall of pier between north and centre basins was completed in June, 1892, the North Quay wall of the latter basin in May last, and the end wall of same is in progress, while the west wall of Dock has been completed for 700 ft. 1 in. of its total length of 1,000 ft.

The total water area of the Dock, including canting basin, will be 34¾ acres, and the total length of quay walls 11,289 ft.

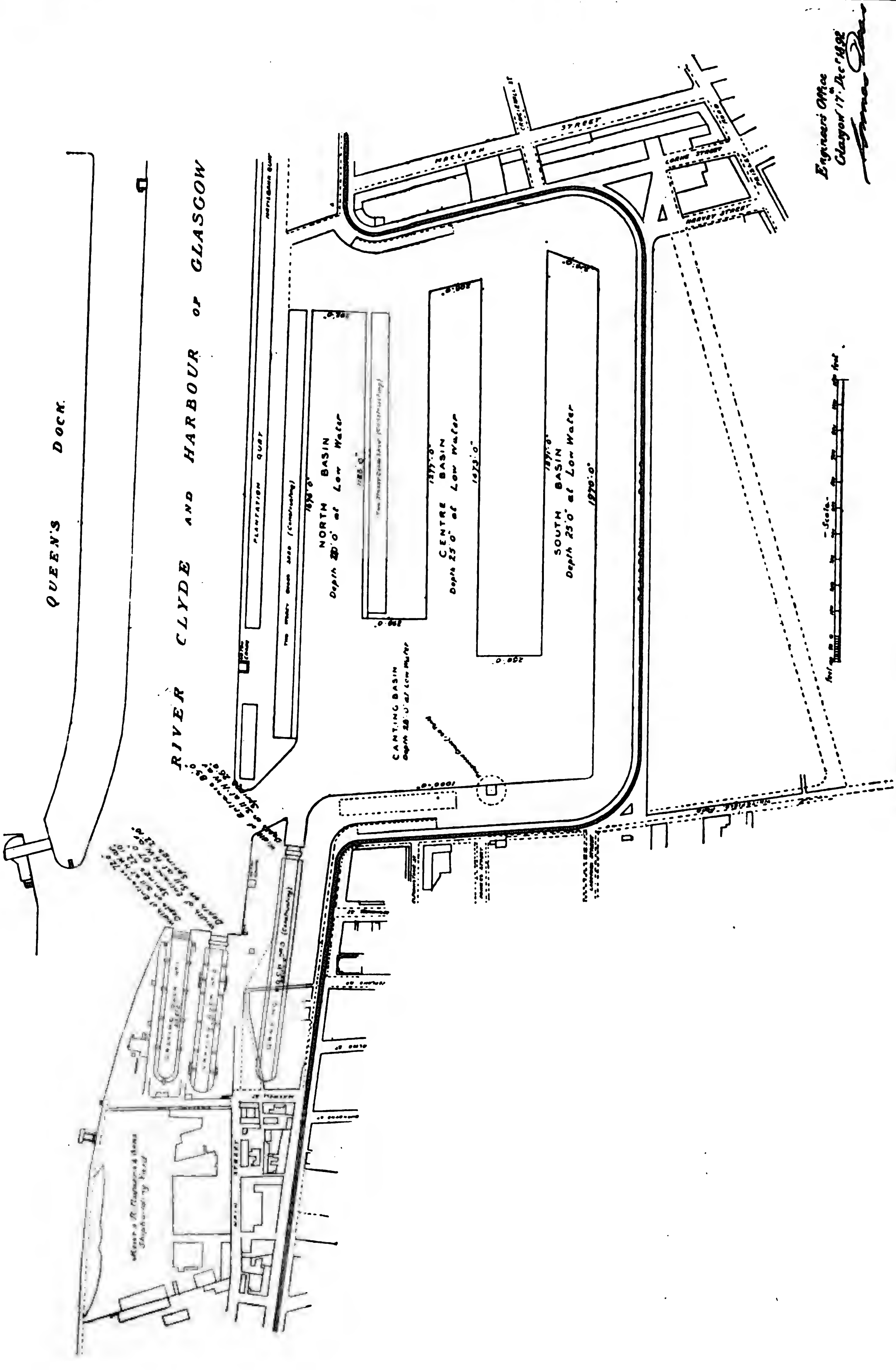
With the exception of the sheds the whole work has been constructed by the Trustees, under the immediate superintendence of Mr. Deas, C.E., their chief engineer, the designer of the Dock, Mr. Archibald Hamilton, being resident engineer.

The soil of the Dock being composed of water-bearing sand with occasional pockets of clay, Mr. Deas, in the construction of the quay walls, followed the method first adopted by him several years ago in the construction of the walls of the harbour and Queen's Dock of triple concrete cylinders as a substructure, with concrete masonry faced at first with freestone ashlar, and in recent years by concrete ashlar.

As the details of this mode of construction may interest our readers, we will shortly describe same as presently being carried out in the construction of the Cessnock Dock. The cylinders are made in rings 2 ft. 6 in. deep by 1 ft. 11 in. thick, in moveable wooden moulds on a platform. The concrete employed consists of five of gravel or broken stones and sharp sand to one of Portland cement of the strongest description, and the materials are mixed in a mixer designed for the purpose, and actuated by steam power. Water is added to bring the mass into a plastic state. In order to facilitate handling, and to break bond when built, the rings are divided into three and four pieces alternately. The dividing of the rings is effected in the moulds by malleable iron division plates ⅜ in. thick. These are placed across the wooden moulds in the proper positions before the concrete is filled in. In filling the moulds the concrete is well rammed to secure a homogeneous structure and a smooth surface. In twelve hours the division plates are withdrawn, and two days afterwards the wooden moulds are removed. The rings are ready for removal after a period of from nine days in dry hot weather to three weeks in wet or cold. The cubic contents of one ring complete is 10⅓ cubic yards, and the weight is 18 tons, the heaviest portion being about 6 tons. Each of the cylinders is made up of 14 or more rings according to the depth of water required in the dock, and is 36 ft. 6 in. or more in height. The lowest ring is different from the others, being thinner at the bottom and fitted into a cast-iron shoe. This shoe is 2 ft. deep, of 1 in. metal, and of the same size and shape externally as the other rings. The underside of the bottom ring rests on a shelf in the shoe about 6 in. below its top edge. The shelf is formed of an inner ring of cast iron 1 in. thick, projecting at the top 12 in. inwards, and tapering outwards to the bottom of the shoe, where it joins the outer ring, thus forming a cutting edge to the shoe, the wedge-shaped space between the outer and inner rings being filled with concrete. The shoe weighs about 4 tons 10 cwt., and for convenience in placing in the trench is made in six parts. The method of construction is to cut a trench along the line of the proposed quay wall. The bottom of the trench is 2 ft. below low water level, where it is made 21 ft. wide, the sides sloping upwards with a batter of 1½ horizontal to 1 perpendicular. At the side of the trench is placed the necessary staging to carry the travelling cranes and digging apparatus, and the shoes are placed at the bottom of the trench in the line of the quay wall, the space between the outer and inner ring of the shoe being filled with concrete. The lowest or "corbelled" ring is placed on the shelf in the shoe, and bolted to it by thirteen 1¼ in. bolts, a malleable iron ring 5 in. by ½ in. thick being sunk into it on the top, the place for this ring and for the bolts passing through the concrete ring having been made in the moulding of the latter. The remaining 13 rings or more forming the cylinder are set one on the top of the other in Portland cement in three and four pieces alternately so as to break bond as already explained. The cylinders in groups of three are placed in the trench so as to dovetail into each other, one in front and two behind, and two in front and one behind alternately, the sides of the groups where they press against each other being flattened for a length of 5 ft. to ensure a good bearing. Upon the completion of the building-up of the rings forming one group of cylinders, the sand and gravel are dug out from within each of the three cylinders by means of excavators specially designed for the purpose. From 400 to 450 tons of cast-iron weights of the same shape as the rings are generally required to force each group of cylinders down to the proper depth, which is 55 ft. and upwards below cope level of the Quay, the tops of the cylinders finishing about 9 in. below low water level. The average rate of sinking is about 12 in. per hour. In good working sand as much as 3 ft. per hour has, however, been attained. When the group has been sunk, it is cleaned out by means of excavators to the level of the bottom of the shoe, and each cylinder is then filled to the top with Portland cement concrete. On this foundation the quay wall is built. The walls are of concrete rubble, many of the stones weighing two or three tons each, faced with concrete ashlar in courses ranging from 18 in. to 15 in. in thickness the blocks being not less than 4 ft. long by 2 ft. broad in the beds, and the headers not more than 10 ft. apart at the centre. The cope is of granite, 3 ft. 6 in. broad by 15 in. thick, in lengths not less than 4 ft. The mooring paals or bollards, which are 64 ft. apart centres, are built into the wall immediately behind the cope. To close up the apertures, formed by joining the groups of cylinders in an effectual manner, a timber chock pile, 30 ft. long by 11 in. square, is driven behind angularly, so that a sharp corner may bear hard against the cylinders. To strengthen the end wall of North Pier, where a pocket of soft clay was met with, twin cylinders were placed behind the triple cylinders, and the two lines of cylinders bound together at the top by old malleable iron rails. This increase in the breadth of the base enabled the thickness of the superstructure to be increased from 16 ft. to 26 ft. and 28 ft. deep at low water to be obtained thereat, and the same arrangement is being carried out in the construction of the west wall of the Dock, so as to get 28 ft. depth of water at low water, and 39 ft. at high water, ordinary spring tides, in the canting basin, of which the west wall forms a side. The walls of the three berthing basins are constructed to give 25 ft. at low water and 36 ft. at high water of same tides.

The canting basin is 700 ft. by 685 ft. The north basin averages 220 ft. broad, and the other two basins will have an average width of 200 ft. The north pier separating the north and centre basins is 250 ft. wide, and the centre pier will be of the same width. Provision is being made on the west quay of the Dock for a steam crane capable of lifting 130 tons.

Sloop Alert.—The Admiralty have given instructions for the machinery of the new sheathed sloop *Alert* to be made in the steam factory at Sheerness Dockyard. The *Alert* is one of a pair of new sloops designed by Mr. W. H. White for service in foreign waters, and is to be fitted with engines of the triple-expansion type, estimated to indicate 1,400 H.P. under forced draught and 1,050 H.P. under natural draught. The speed of the *Alert*, which is shortly to be laid down in No. 2 dock, is estimated at 13.25 knots under forced draught and 12·25 knots under natural draught.

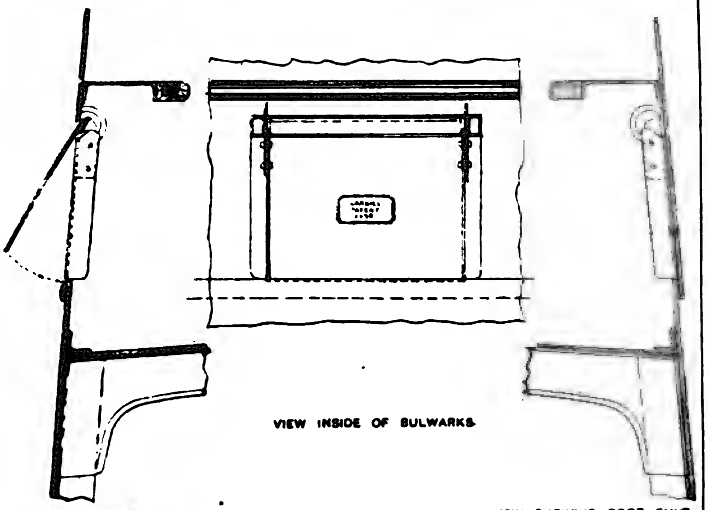


THE DOCKS OF GLASGOW. (see page 232.)

LAMBIE'S PATENT BULWARK PORT.

We illustrate in the adjoining diagram a new method of constructing and fitting water port doors for ships' bulwarks above the decks, which has been invented by Mr. Lambie, manager to the firm of Messrs. Russell & Co., shipbuilders, of Greenock. The main object of the invention is that the doors will be opened by any pressure of water within the ship, to discharge the same overboard and will automatically close again, and prevent any inflow of water from the sea through the bulwark port holes.

As will be seen from the diagram, eyes or recessed projections are fitted on the bulwarks on each side of the upper part of the port-holes, and the inner edges of the front part of these eyes are formed with angled or inclined planes or surfaces. The top edge of each port door is formed with a longitudinally projecting out and up surface or stop flange, which closes outwards on the edge of the port hole and has formed or fitted near its two ends projecting, bearing brackets



VIEW SHOWING DOOR OPEN. VIEW SHOWING DOOR SHUT

with rounded tops and front inclined faces, corresponding to and fitting over the inclined surfaces on the fixed eye projections. By this construction the doors can move by its projecting lugs on the bearing rests within the eyes fitted on the bulwarks and when the sea is washing over the ship, the water, in pressing against the lower part of the door, automatically opens the same, the lugs on its upper end moving inwards over the inclined or rounded surfaces to the rounded or stop portion of the eyes. When the water has been discharged overboard, the door will automatically close again by its own weight below the fulcrum, the inclined surface of the lugs moving outwards and downwards and bearing tight on the inclined surfaces of the eyes on the bulwarks, so that the upper edges of the door above the fulcrum close outwards, while the lower edges below the fulcrum close inwards against the port holes in the bulwarks. Projecting vertical check plates are fitted at the ends of the port hole so that the door may close against their overlapping vertical edges, above and below the fulcrum so as to be flush with the side of the ship; while the top edges of these check-plates are inclined to the same angle as the eyes, to receive part of the acting inclined surface of the projecting portions on the top of the door, the bottom of the angled surfaces being made bevelled or square for the corresponding top edge of the door to make a tight fit, and the longitudinal upper and lower edges of the port hole and door are bevelled so as to be nearly watertight when closed.

The inventor claims that his invention has many advantages over others at present in use, as by its simplicity and self-acting arrangement it is unrivalled as a freeing port. Further, being made without fixed hinges or ship-bolts any trouble from these causes is avoided and the door can only open by pressure of water from the inside, and no water can get through from the outside, also it is not affected in any way by the rolling of the vessel. We understand that the arrangement has been approved by Lloyd's Committee.

THE PALACE STEAMER "ROYAL SOVEREIGN."

We have on former occasions pointed out how large a field for enterprise exists in the providing of first-class accommodation for the conveyance of passengers by water to places on the Lower Thames. The traffic this year has been signalised by the placing on the river, by the Victoria Steamboat Association, one of the finest, if not the finest steamer of its class that has yet been built, which they have named the *Royal Sovereign*. On the 17th of August it was our privilege and pleasure to accept an invitation issued by the Directors of the Victoria Steamboat Association, Limited, for a cruise in the Palace Steamer, *Royal Sovereign*, to Ramsgate and back, and found that the steamer was all that they have said of it. The *Royal Sovereign* is a saloon paddle steamer, 312 ft. in length; breadth of hull, 33 ft.; extreme breadth over paddle-boxes, 58 ft.; and depth moulded to main deck, 11 ft. Her nett tonnage is 189 tons. The hull is built entirely of steel; all the structural scantlings have been approved by the Board of Trade, whose officials superintended the erection of the vessel throughout. In view of the important service in which the vessel is to be engaged, great attention has been given to the subdivision of the hull into watertight compartments by steel bulkheads, to ensure that the vessel will be practically unsinkable, and in this direction effect has been given to the fullest extent to the recommendations of the recent Bulkhead Committee, the *Royal Sovereign* being, in fact, one of the first vessels of her class to conform to the necessary qualifications. To do this it was found necessary to divide the first-class dining-saloon in two by a steel bulkhead, while for convenience in serving the after portion, a watertight door, worked by gear from the deck above, has been fitted in the division. On an emergency this door can be immediately closed, and any person thus shut off may reach the upper deck through an escape stair and well, fitted in the deck saloon, and which will always remain open. Tne *Royal Sovereign* is fitted with compound diagonal surface condensing engines. The cylinders are placed side by side, and work on two cranks set at an angle of 90 degrees. The high pressure cylinder is 50 in. diameter, and the low pressure cylinder is 82 in. diameter, each adapted for a stroke of 5 ft. 6 in. The crank and paddle shafts are of mild steel, the crank shaft being forged in one piece, and connected to the paddle shafts by flanged couplings. Each cylinder is fitted with a flat slide valve, worked by the usual double eccentrics and link motion, and the starting and reversing are effected by one of Messrs. Brown Brothers' steam and hydraulic reversing engines. The condenser is cylindrical, and placed between the cylinder and the supports for the crank shaft. An ample supply of condensing water is supplied by a centrifugal circulating pump, worked by a separate engine, and made by Messrs. W. H. Allen & Co., London. Steel has been used where possible, so as to minimise the weight of the engine. The two paddle-wheels are constructed on the feathering principle, each wheel being fitted with curved floats. The wheels are of steel throughout.

Steam is supplied by four low double-ended boilers of steel, designed for a working pressure of 120 lbs. per square inch. Each boiler has four corrugated furnaces, making a total of sixteen furnaces. There are two funnels arranged so that they may be lowered or raised by small steam winches and gear. This is necessary, as the vessel must embark the passengers at the Old Swan Pier, above London Bridge. A fan is fitted into each stokehold, to be used if required, to maintain a sufficient supply of air, and to assist the natural draught under adverse atmospheric conditions. Like the funnels, the mast also may be lowered, for which purpose it is hinged upon a horizontal pivot. For convenience and safety in going astern or turning in harbour or narrow channels two rudders have been fitted, one at the bow in addition to the ordinary one aft. The latter is worked by a steam-steering apparatus fitted on the engine platform, and thus under the immediate care of the chief engineer and, as is usual, controlled by suitable connections from the wheel on the captain's bridge. The bow rudder is provided with a patent screw-steering gear, with necessary locking-pins. The vessel may thus be steered by either head or stern. A steam windlass with capstan, is fitted forward to work the cables and moorings, while two patent stockless anchors of suitable weight are ready stowed for immediate use when required. On the main deck abaft the saloon a neat steam capstan is also fitted to work the mooring ropes. This will doubtless save much time and labour at the various piers. It will also serve in warping the vessel and turning in harbour, thus proving itself another of the advantages the modern captain enjoys compared with his predecessors. Nowhere has there been greater advances of recent years than in the growing comfort and luxury of passengers' accommodation. It has, however, been the aim of both owners and builders to even excel anything yet accomplished, and in this they have been eminently successful.

Two spacious deck saloons, forward and aft of the machinery spaces respectively, give the vessel a most handsome appearance, and serve to provide both classes of passengers with airy and comfortable accommodation in the event of rain. They will thus avoid the stifling crush too often experienced when shelter is more limited. Above the saloon the deck extends fore and aft the full breadth of the vessel, and affords an excellent promenade. On this deck are two houses of teak wood. The midship house contains a large private cabin, framed in polished mahogany, and upholstered in the finest scarlet morocco, with Brussels carpets, chenille table-covers, and brocade window-curtains. There is also the captain's cabin, and a purser's room and ticket office. These are finished in polished hardwood, suitably furnished and upholstered in velvet, with brocade window-curtains. Connected with the ticket office is a "Post office," where letters, telegrams and parcels will be received for dispatch at the various places of call; over this house is the navigating bridge, with the usual steering standard and telegraphs to the engine-room, mooring-stations, bow, rudder and windlass. The after-house (also of teak) is fitted as a first-class smoking room and bar, with all the necessary fittings. This apartment is finished in dark mahogany, and upholstered in morocco.

As is usual on river steamers, the classes of accommodation are separated by the machinery space, and a neat rail fitted on the promenade deck serves as a line of demarcation. A collapsible gate fitted in each alley-way amidships serves a similar purpose on the main deck. In the first saloon accommodation, are included the smoking-room, upon the promenade deck already mentioned and the general saloon on the main deck, at the forward end of which are three private state rooms. The general saloon, including the entrances and staircase, is framed in rich mahogany French-polished. The panels at the end are fitted with large bevel edged glass mirrors, and tasteful designs, hand-painted on light wood panels. The floor is laid with rich Brussels carpet and the sofa seats and pillows are covered with velvet. The private state rooms are fitted in elegant style, each room having a characteristic and distinctive colour. Throughout the saloon special arrangements have been made for a plentiful display of flowers. The ladies' boudoir, which is arranged at the after-end of the saloon is framed in white enamel, the panels being beautifully gilded and tinted in colour. The ceilings throughout are also lined and panelled in white enamel relieved with gold.

The cabin sole aft below the general saloon is entirely occupied by the first-class dining saloons, pantry, bar, and a private room. Here, as in the smoking room, a pleasing effect has been produced by laying the deck planks alternately in teak and yellow pine. The sides are decorated with hand-painted panels, the sofas and chairs are upholstered in scarlet morocco, port lights hung with curtains of brocade. Dining accommodation is provided here for 180 persons at one sitting.

Ample sanitary accommodation is provided in the sponson houses, a special feature being the arrangement of one room fitted with a solid marble bath, in which passengers may enjoy the luxury of a salt water plunge *en route*. A hairdressing establishment on the main deck, at the fore end of saloon, is replete with every toilet requisite, while immediately opposite is a large and commodious cloak-room.

The forward part of the promenade deck and the whole of the forward deck saloon, including a separate smoking and refreshment room are reserved for the use of second-class passengers; and the accommodation here provided closely approaches the comfort and luxury of ordinary first-class saloon accommodation. In the deck saloon, which is furnished in polished teak, will be found a bookstall and a coffee buffet, which will doubtless prove a great convenience. The dining saloon is immediately below and is finished in white enamel; the seats are covered with carriage repp; merino curtains are fitted to all the ports. The rooms for chief officer and chief engineer are placed on the forward sponson. Commodious quarters for the junior officers, engineers, and crew in the forecastle; while at the after end of the second saloon accommodation is provided for the stewards. Particular attention has been given to the ventilation of all the compartments, especially the dining saloons; and patent exhaust and inlet ventilators are fitted which cause a constant current.

The vessel is fitted with a complete installation of electric light by W. Mackie, of Turnmill Street, E.C., including two embarkation lights, one at each end of the bridge, which will be very useful to illuminate the gangways when landing passengers after dark. A complete system of electric bells is also provided.

There is, of course, the full complement of boats and life-saving appliances to the latest Board of Trade Regulations, and one of the life-boats is kept hanging from the davits, ready for launching at any moment. The life-saving appliances take the form almost entirely of seats in the nature of rafts with halyards attached, each of which will support many persons in the water.

The steamer is licensed by the Board of Trade to carry 2,320 passengers, and her speed is upwards of 19½ knots per hour with natural draught.

The vessel was built and engined under the superintendence of Mr. Peter Blair Black, M.I.N.A., the company's consulting engineer, by the Fairfield Shipbuilding and Engineering Co., Limited, of Glasgow.

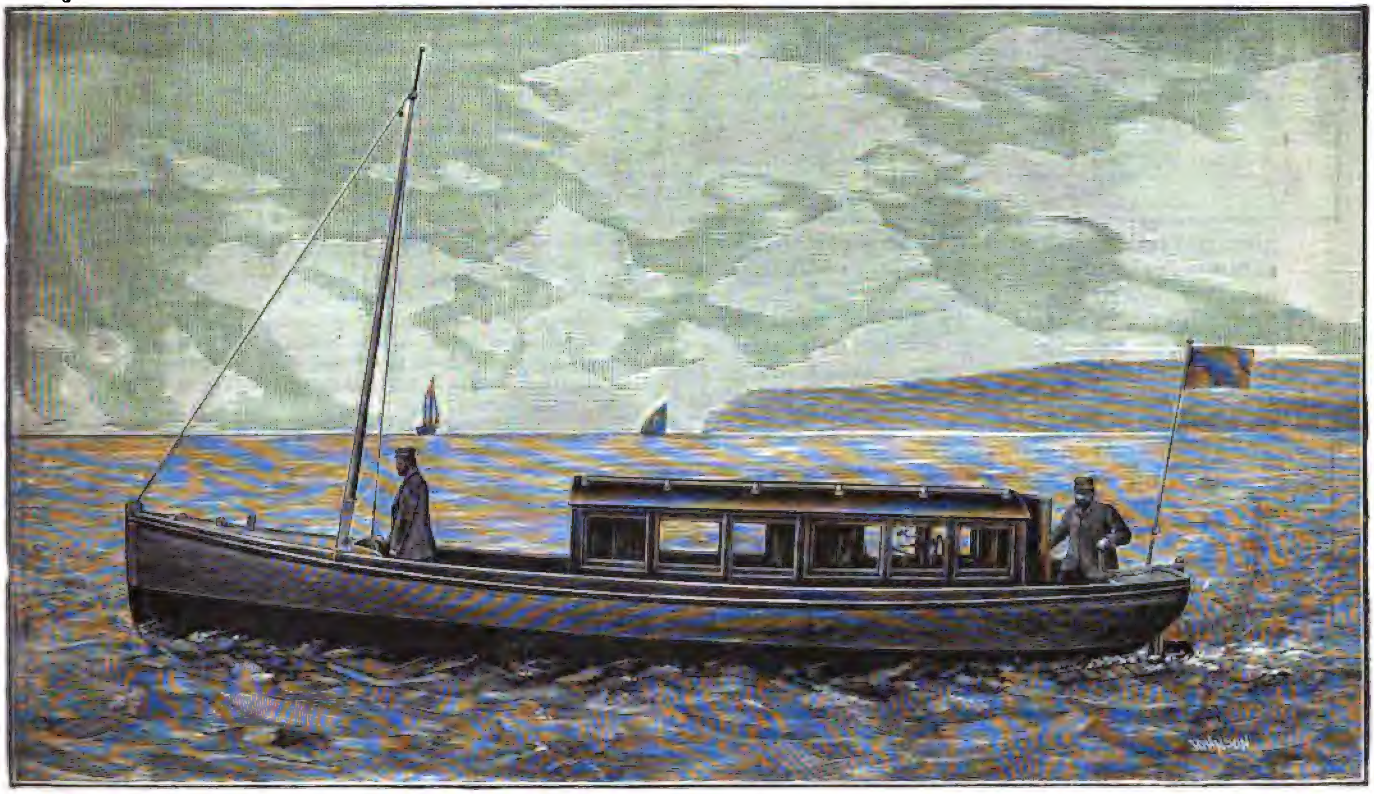
During the cruise the guests were regaled with a luncheon and a dinner, and were treated with every consideration by Mr. Arnold Williams, the managing director, and other members of his staff, and by Captain Fishenden, the commander of the vessel.

The weather was all that could be desired, and the trip was most enjoyable, and proved to those on board that to really make life worth living in the torrid atmospheric conditions that have been experienced during August, one has only to take a trip in the *Royal Sovereign* to Margate or Ramsgate, to enjoy a blow of cool fresh air that has such a refreshing and exhilarating effect upon the poor specimens of humanity whose fate it is to be stifled in an office in the hot weather all day long.

OIL LAUNCHES.

We have pleasure in bringing to the notice of our readers the particulars of a 30 ft. Oil Launch, which we understand has been delivered to Sir James Colquhoun, of Loch Lomond, in the month of July, by the builders, Messrs. Vosper & Co., of Portsmouth and London, an illustration of which we give in the adjoining diagram. She is a very handsome boat, built of teak, and has the following accommodation :—A nice cabin, 6 ft. long, which is continued over the engines which are placed aft; this

arrangement not only gives spacious cabin room, but a cock pit, 7 ft. in length. There is also 6 ft. of deck, upon which the steering wheel is placed, with a voice tube to the engine-room. Further arrangements are made by which a single man can both attend to the machinery and steer the boat. The engine will develop 6-brake H.P., and is capable of driving the boat over seven miles per hour. It is noteworthy to remark that both Lady and Sir James Colquhoun have expressed their surprise at the total absence of smell and vibration, which speaks for the high state of perfection to which Messrs. Vosper & Co. have attained in their engines and to the thorough manner in which the combustion of the liquid fuel is carried into effect, there not being, we understand, the smallest sign of smoke. The firm have now a similar boat on order, and several engines for boats being built in various parts of the world. There is little doubt that this type of motor is very applicable for the kind of boat shown in the diagram, as little or no loss of time is incurred in getting the motive power into action at its full power, and we think that there will be considerable development in machinery of this type as its advantages become better known.



Oil Launch built by Messrs. Vosper & Co., of Portsmouth (*See page* 236.)

TUCK'S TRIPLE PACKING.

In our last issue, in the account of the proceedings of the Institution of Naval Architects, at Cardiff, we inadvertently omitted to mention a visit to works of considerable interest; we refer to those of Messrs. Tuck & Co., Limited, packing manufacturers. These works were erected in 1887 for the manufacture of one of the firm's specialities, viz., Tuck's triple packing, as well as other descriptions of Asbestos goods.

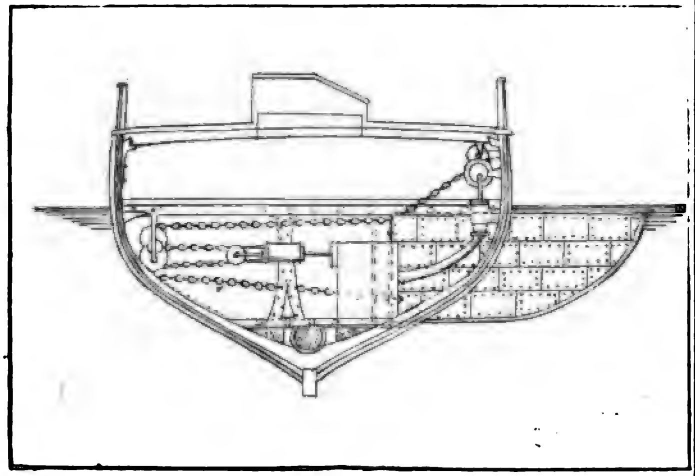
The triple packing was introduced to meet the want of a reliable packing for use in triple-expansion engines under a pressure of 150 lbs. per sq. in. The inspection of the works revealed the following interesting particulars as to the manufacture of the speciality:—The triple packing as now manufactured consists essentially of a rope of asbestos partly twisted and partly braided, interlaced with strands of anti-friction metal. This latter when placed in the stuffing box of the engine forms an excellent wearing surface, while the asbestos, being soft and compressible, tends to prevent the escape of steam, and being also incombustible, is unaffected by the heat.

The asbestos is received at the works in the form of yarn of various degrees of fineness, the operations of reducing it from the crude state being performed at other works. The first process is that of worming, or preparing the strands to form a core or foundation. These cores are then laid together, as many as necessary for the size of packing required, and are transferred to a machine, which carries alternate bobbins of asbestos and anti-friction metal in the form of wire, caused to revolve, and delivers a coil of rope stranded together, asbestos and wire alternately. This coil is then removed from the machine and passed on to another, which covers the rope with a layer or brand of asbestos yarn, and finally to a braider, which gives the last covering, and delivers the packing ready for use. It is interesting to note, by one of the testimonials received by Messrs. Tuck, how well the packing behaves under trying circumstances, it states that some of this packing fitted in May, 1889, to an engine for an electric light installation, has been working at 140 lbs. per sq. in. pressure for ten hours a day ever since, and is now as good as ever, the rods being in perfect condition.

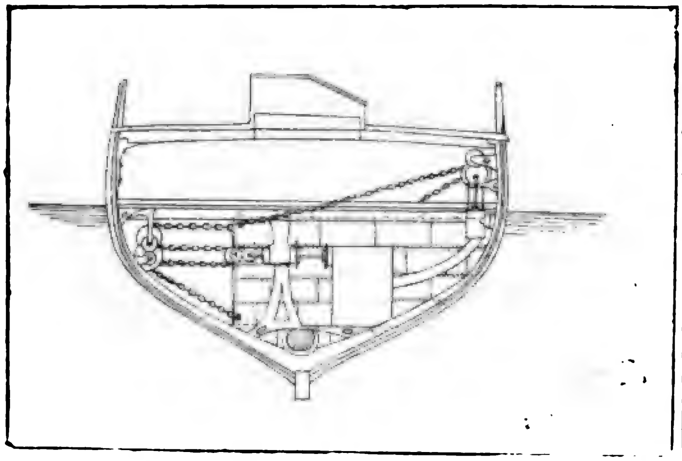
Messrs. Russell and Co., Port Glasgow, have received orders to build a sailing ship of 3,500 tons dead-weight, and a steamer of 5,000 tons for Wright and Graham, formerly Wright and Breckenridge, of Glasgow.

STEERING AND STOPPING APPARATUS FOR SHIPS.

A NEW method has been devised for steering and stopping ships which we illustrate in the adjoining diagrams which as far as the general arrangements are concerned are clear enough to show the



idea. The method consists in providing slides or shutters enclosed within, and working out from narrow chambers constructed in the interior of the vessel, preferably between the watertight bulkheads or divisions, an aperture being provided on each side of the vessel below the waterline, through which the slides can be projected into the water when wanted for use. The slides are worked either by hydraulic or



steam gear, and either slide can be projected from the ship independently or both together as circumstances require, viz.: to turn her either one side or the other, or to stop as soon as possible in her course.

We only give the description as it was received by us and do not express any opinion on the practicability of the idea but leave our readers to form their own opinion.

MR. VANDERBILT'S YACHT "VALIANT."

THE twin-screw yacht *Valiant*, built for Mr. W. K. Vanderbilt by Messrs. Laird Brothers, of Birkenhead, sailed for America on Wednesday, August 16th, exactly nine months from the day on which the contract was signed.

The *Valiant* is by far the largest yacht in the world, being 2,400 tons register, and driven by engines developing 4,500 H.P., and her length is 312 ft. In addition to her engines the yacht carries two masts, square rigged, and capable of spreading a great area of canvas. Great care, almost secrecy, has been observed about the details cf the vessel, but from the description given below it will be seen that she is fitted in the most luxurious style, and is one of the finest, as well as the largest yacht afloat. A fact remarked by many who saw her on her last trial trip was that she carried the British flag, and, therefore, her registered owners are British—a circumstance of some significance. The general fitting of the vessel is characterised by being "the best of everything," as an instance of which we may say that every hinge, bolt, catch and rail—excepting the awning rails—are of Wilson's white metal, a composition almost entitled to rank with the precious metals. Even the huge ventilators are constructed of this silvery alloy. Even in the matter of piping, equal excellence obtains, all the pipes for supply and waste, for hot and cold water, lavatories, and sanitary appliances, are of the finest copper. Among other details the vessel is fitted with the electriclight throughout, has patent signal light indicators, steering-gear, and every possible improvement to date. Naturally, the cost has been enormous, and it is not improbable that Mr. Vanderbilt will have to expend the sum of at least £150,000 before he can call the vessel his own.

The designer of the hull is Mr. St. Clare Byrne, of Castle Street, a yacht architect who has achieved no little fame by reason of former designs. Mr. Vanderbilt himself has seen to most of the contracts, so that the actual builders of the ship have had less hand in her equipment than is usually the case. Paris, London, and Liverpool have all been requisitioned for the decorative work, the leading firms in each city being entrusted with the various state rooms for embellishment. The actual construction of the deck houses was, of course, left to Messrs. Laird, who built all such first of iron and then an outside panelling of the finest teak, highly polished. The bulwarks, which are movable, are of similar construction, fine teak being about the commonest wood employed on any part of the *Valiant*. In fitting the rooms the builders have not had very much to do, but some beautiful figured teak, finely polished, embellishes the wall of the main companion way, which is really a grand staircase, the material appearing like fine olive wood. The pipe services, baths, and so on have been put in by Messrs. Laird, and no hotel ashore has a more complete system. Every hand-basin, bath, or lavatory waste pipe is carefully trapped, all baths are of Stone's patent enamel on copper, and to every basin or bath is supplied a separate copper service of steam piping for cleaning each place by blowing out. The galleys are fitted with steam tables, ranges, and the most complete service of utensils, the pantries being similarly complemented. The men's quarters in the forecastle are fitted in teak, as are the servants' rooms also, there being bedrooms, bathrooms, and a servants' hall.

Taking the state-rooms, there are about twenty, exclusive of the smoke-rooms, dining-saloon, and library. The two latter, the largest apartments in the ship, are by Messrs. Cuael, of Paris. This saloon is 18 ft. in length and 33 in width, running practically the whole breadth of the ship. The general design is Louis Quatorze, and the wood is fine grained French piue, resembling English poplar, but of course the original grain and colour of the wood is hidden beneath the fine white enamel, with its golden embellishments. The carving, which is out of solid wood, is simply exquisite, every foot of the wall panelling being rich in high relief carving, beautifully and artistically done. At one side of the hall is a Steinway piano, and the chair settees are of brass inlaid Chippendale. The furniture is upholstered in rich crimson silk velvet. The dome of the saloon rises to the upper deck, and a soft, sensuous light creeps through its stained panes to the saloon below. Leaving the saloon, a passage of about 100 ft. in length, arched and beautifully decorated, and carpeted with a texture costing three guineas a yard—as are both the saloon and the library—leads to this latter apartment, where again the hand of the carver has had free play. This apartment is of dark walnut, unpolished; the panels and pilasters rich with the most beautiful carving, which indeed embellishes the entire apartment. The settees, sideboard, and general fittings are all of dark walnut, and overhead are beautiful panels of the same wood, chastened with soft-tinted paintings. The fireplace and mantelpiece are the finest bits of work in the ship, being massive, and exquisitely carved.

Mr. Vanderbilt's state room, by Messrs. Waring & Sons, is fitted up in a particularly luxurious style, the furniture being of richly figured pollard oak, and consisting of a spacious wardrobe fitted with every conceivable accommodation. One corner of the room is fitted an ingle nook fitment, the seats upholstered in rich cream ground and floral designed French silk, and above are cupboard and bookcases enclosed by doors panelled and fitted with bevelled glass. Under and between the ports are seen a specially designed very effective pollard oak cabinet or sideboard, an escritoire fitted with stationery appurtenances, bookcase, cupboards above, and a large lounge or settee, richly upholstered and covered with silk *en suite* with the ingle nook. The bedstead is made of pollard oak, with convenient cupboards below, the footboard panelled and carved and having a canopy headboard. The wall spaces, which are very limited owing to the fitments covering almost all, are panelled with the same silk as is used in the upholstery, and the ceiling frieze and beams are covered with Tynecastle tapestry, decorated in a tone of ivory white. The carpet is a blue shaded floral design Wilton, harmonising with the tints in draperies. Adjoining this room, and approached through a pair of handsomely panelled and carved doors, is the bathroom and lavatory, fitted up and decorated in the most elegant manner.

Mrs. Vanderbilt's forward state room ornamented by Messrs. S. J. Waring and Sons, is another exceedingly tasteful and elaborate apartment, the treatment of the detail in decoration and panelling revealing the choicest combination of colouring and delicate treatment. The ceiling, friese, and arches are covered with a special design of Tynecastle tapestry, decorated with a rich ivory white, the wall spaces being panelled with a light blue with stripe and floral design rich French silk. The fitments and furniture are of a very beautiful character, especial consideration having evidently been employed to produce so rich an effect. On one side is fitted an elaborate washstand, a large pedestal dressing-table stands next to it and is fitted with numerous drawers, jewel-boxes, silvered bevelled plates, &c. At one end of the room, facing the bedstead, is fitted an elegantly designed wardrobe. On the side and under the ports are fitted a large chest of drawers, a writing-table and combination bookcase, and next is the bath, with a rising top richly upholstered, which acts as a lounge in the daytime. The bedstead is a perfect *objet d'art*, decorated in ivory white, as are all the other fitments in this room. It has a large footboard with richly carved panels, fluted pillars, and large drawers, the head end being a high circular canopy, draped with rich silk festoon valance, fluted headboard and top, festooned and tail draperies, &c. The ports are enclosed with enamelled wood fitments, and draped with silk curtains *en suite* with bed. The carpet is a rich terra-cotta Wilton, harmonising with the tints on the draperies.

Mrs. Vanderbilt's second bedroom at the after end of the ship is rich, but chaste in style—Sheraton enamelled white and picked out with gold, the ceiling being of fibrous plaster, also enamelled ivory white. All the furniture and equipments are thus tinted, and as the wall panelling and draperies are of an old rose colour, rich flowered silk, the effect is warm and soothing to a degree. A fine wooden bedstead is similarly enamelled and draped, and the carpet is a beautiful grey Saxony, like all the after cabins and passages. Out of this room is a neat bathroom *en suite* with the bedroom, but with several wooden panels in place of draperies. The bath fittings are of the silver white metal, and the bath itself enamelled copper. Going up from the main to the upper deck one finds Mrs. Vanderbilt's sitting-room, a beautiful apartment in the old Adams style, the furniture, framings, and casings being of dark mahogany, and the upholsterings and hangings of a peculiar green flowered silk, between apple and sage green in tint. The grate is an open one, the fire-brasses and fenders having been designed to suit the general style of the room. The panels above the mantelpiece, and above a pretty little writing desk at one end of it, are fitted with Wedgwood plaques. The pilasters dividing the panels, and the whole of the mantelpiece, are beautifully carved; and Messrs. Gillow, of London, Lancaster, and Liverpool, who have done these rooms, consider the deck-room one of the best on the ship. The apartment is about sixteen feet square.

Miss Vanderbilt's room (also by Messrs. Gillow) is also very handsome, in the Cawthorne style of about a hundred years ago, the draperies being a peculiar blue and the ceiling a fine bit of Tynecastle work, with frieses of similar work.

The room for Mr. Vanderbilt's private secretary is fitted up by Messrs. Waring in richly figured Spanish mahogany, there being two spacious wardrobes fitted with drawers, trays, hanging compartments, and also a very compact dressing chest, with large silver bevelled mirror over; and for the secretarial duties a very elaborate writing cabinet is arranged, supplied with every necessary arrangement. The bath is cased in Spanish mahogany, panelled and moulded, and has a movable top upholstered in silk, arranged to act as a settee. The bedstead is similarly cased, moulded and panelled, and a lavatory washstand is fixed at the bedside, The ceiling and frieze are covered with Tynecastle tapestry, decorated in a tone of ivory white, the walls being panelled with Tynecastle tapestry, subject panels and mahogany enriched mouldings. The ports are enclosed with mahogany fitments, and draped with silk curtains.

The visitors' room is also fitted up in Spanish mahogany, and is a sumptuously-appointed apartment, containing as it does a large cabinet or sideboard fitted with ranges of drawers, a large washstand with cupboard. A range of cupboards, fitted with sliding doors and shelves, run under the ports with a specially-designed writing cabinet and bookcase, intervening, is next the bath, which is panelled and moulded in mahogany, and has the movable upholstered top for the purpose of a lounge. The ceiling frieze and beams are covered with Tynecastle tapestry decorated. The walls have a high mahogany dado, and the panels are filled with Tynecastle tapestry, decorated subject panels in enriched mahogany mouldings.

The captain's room, another of Messrs. Waring's works, is very finely appointed, fitted up in mahogany, and containing wardrobes, washstand, large chest of drawers, and dressing-table fitted with silvered bevelled mirrors. The bath is panelled and moulded with mahogany, and has an upholstered top as before described. The whole of this work, also the furnishing of the officers' quarters, linens, &c., have been supplied by Messrs. S. J. Waring & Sons, Limited, and needless to say they have exerted themselves to the utmost, with the result that they have produced a most successful and eminently valuable addition to the field of furnishing and decorative art.

Messrs. Gillow are responsible for a fine social hall in the Francois I. style, the room being completely fitted in fumed oak, with elaborate carvings, the coverings of the furniture and the draperies being of rich red damask. The general state rooms at the after end of the ship, which Messrs. Gillow have also done, are all pretty much alike in their elegance, but are draped in different coloured silks or tapestries.

There is also a smoke-room, by Messrs. Howard, London, who have put on some splendid panelling in Spanish mahogany, the room being at the fore end of the deckhouse, and so designed as to meet the wants and comforts of smokers.

The speed of the vessel is given at varying figures, but 16 knots is most probably her rate of progression, although it has been stated that she has done 18.

The engine-room staff is about twenty all told, and the same number is approximately that of her deck crew.

The hull of the ship has been painted with Messrs. J. Dempney & Co.'s enameline anti-fouling composition. It is claimed for this composition that it is a thorough protection against rust, barnacles, and all marine accumulations, while it does not blister under any temperature. After the yacht's bottom had been covered with this enameline it presented a smooth, glossy surface not unlike that produced by fine enamel.

Electric Wiring.—We have pleasure in bringing to our readers' notice the new system of electric conductors, which is known as "Andrew's Concentric Wire System." The main feature of novelty of this system is that by the concentric disposition of the two cables and the insulation about one another, the usual complicated arrangement of two wires and wood casing usually employed in wiring a building or ship, is reduced to a single self-contained cable which requires no protection of any kind whatever. The following are the advantages which are claimed for this system over other systems at present in use:—1. It is cheaper. 2. It is at least three times more durable. 3. It occupies only 1-10th of the space. 4. It is infinitely safer from fire risk. 5. It cannot be injured by rats or mice. 6. Only one half the labour and disturbance of fitting up is incurred. 7. It is far superior in neatness and simplicity. 8. Finally, it is a complete system, perfect in every detail, mechanical and artistic. This system has been fitted on a good many ships, and from the testimonials given appear to have given every satisfaction. It is carried out by J. D, F. Andrews & Co., Marsham Street Electric Works, Westminster.

EXHIBIT OF THE INTERNATIONAL NAVIGATION CO., OF PHILADELPHIA, AT CHICAGO.

ONE of the most striking and elaborate exhibits in the Transportation Department, is that of the International Navigation Co., of Philadelphia. It is situated on the main aisle of the building, near the entrance at the southern end, and consists of a full sized section of one of the new American Line steamers, now being built by the Wm. Cramp & Sons Ship and Engine Building Co., at their yard in Philadelphia.

The section is over 70 ft. long and 35 ft. wide or a little more than half the beam, and about one-seventh the length of the ship itself.

The floor line of the building comes just where the 26 ft. water line of the ship would be, so there is as much of the ship above the floor as there will be above the water at her draft on sailing, and if a complete section of the ship was shown it would have to go down into the ground 26 ft., or make the top of the funnel 26 ft. higher. As it is now, the first or promenade deck is over 25 ft. above the floor, and the top of the funnel is 53 ft. above this again. This fact will serve to give some idea of the actual height of one of these great Transatlantic Liners.

When one enters the southern end of the building the first thing that strikes the eye is the immense funnel of the exhibit, painted black with a white band, the distinguishing mark of the American Line, and which has been made well known on the Atlantic by the famous steamers *Paris* and *New York*. As you approach the vessel you see the black iron sides of the ship, studded with port holes, extending along the aisle and rising to a height of 17 ft. above the floor, where the plating ends, and the railing on the second or saloon deck commences. Above this is the first or promenade deck, which is also guarded by a railing. Above this again rises the highest part of a ship (except the rigging), the bridge, from which the officers direct the course of the vessel.

Just aft of the bridge, and on top of the deck-house, is a lifeboat with the davits to launch it, if necessary.

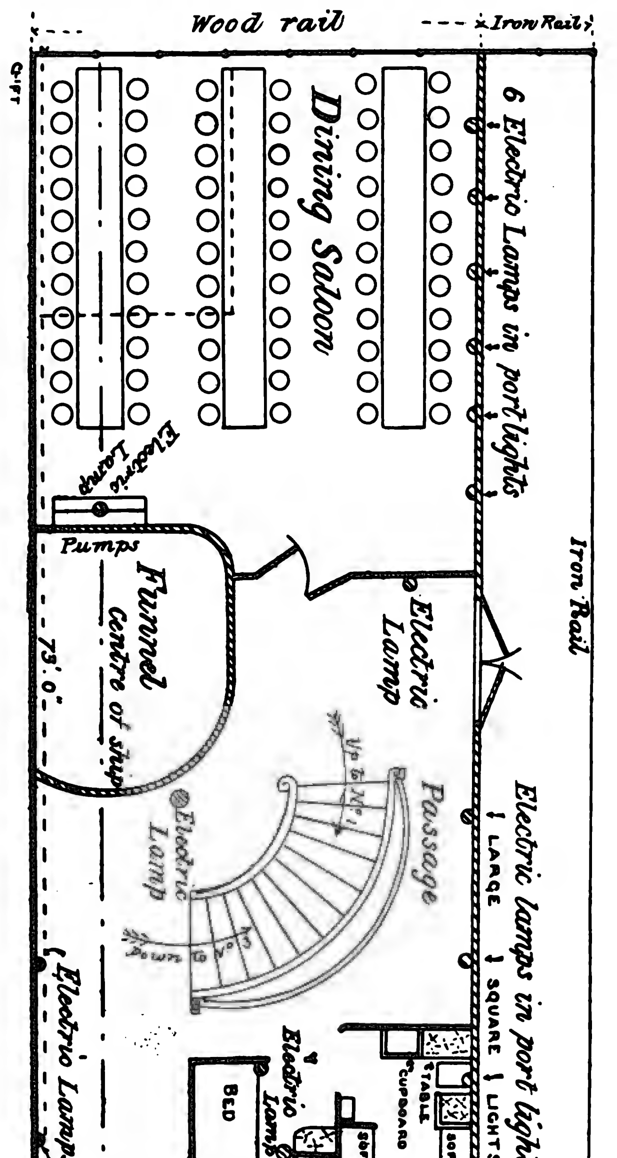
On passing round the end of the exhibit it can be plainly seen that it is only a section of a ship, as the ends are cut off square, and left open so that all four decks, and to some extent what is on each one, is visible.

The first compartment seen on entering from the floor is called the model room, and in it are displayed the models of some of the steamers of the Line. The finest and most complete of these, that of the steamship *Paris*, was awarded a gold medal at the Exposition of Paris in 1889.

Next to the model room, and on the same deck, is the steerage compartment. This room is completely fitted up to represent the steerage of a ship. There are thirty-two berths, divided into three "family rooms," and one group of men's berths on one side and the table at which they eat is shown on the other.

The next deck is reached by stairs leading from the model room, and these land in the first-class compartment, which is fitted up with three cabins, holding four persons each, a bath room and a toilet room. The rooms are fitted up with the latest improvements in sofa and extension berths, and are so arranged that two of them can be made to communicate, making a very convenient arrangement for families.

The other compartment on this deck is fitted up with second-class rooms, of four berths each. About the only difference that is at first noticeable between



the first and second class cabins is the absence of a sofa in the latter, and a different style of washstand.

All the cabins are lit by electric light, and each cabin has at least one port hole, the first-class rooms having two.

On ascending to the next deck we enter a large open space or hall, which is very handsomely finished in dark mahogany and gold. Turning to the right and passing through the hall we enter the dining-saloon. This is a most attractive room, the woodwork, in-

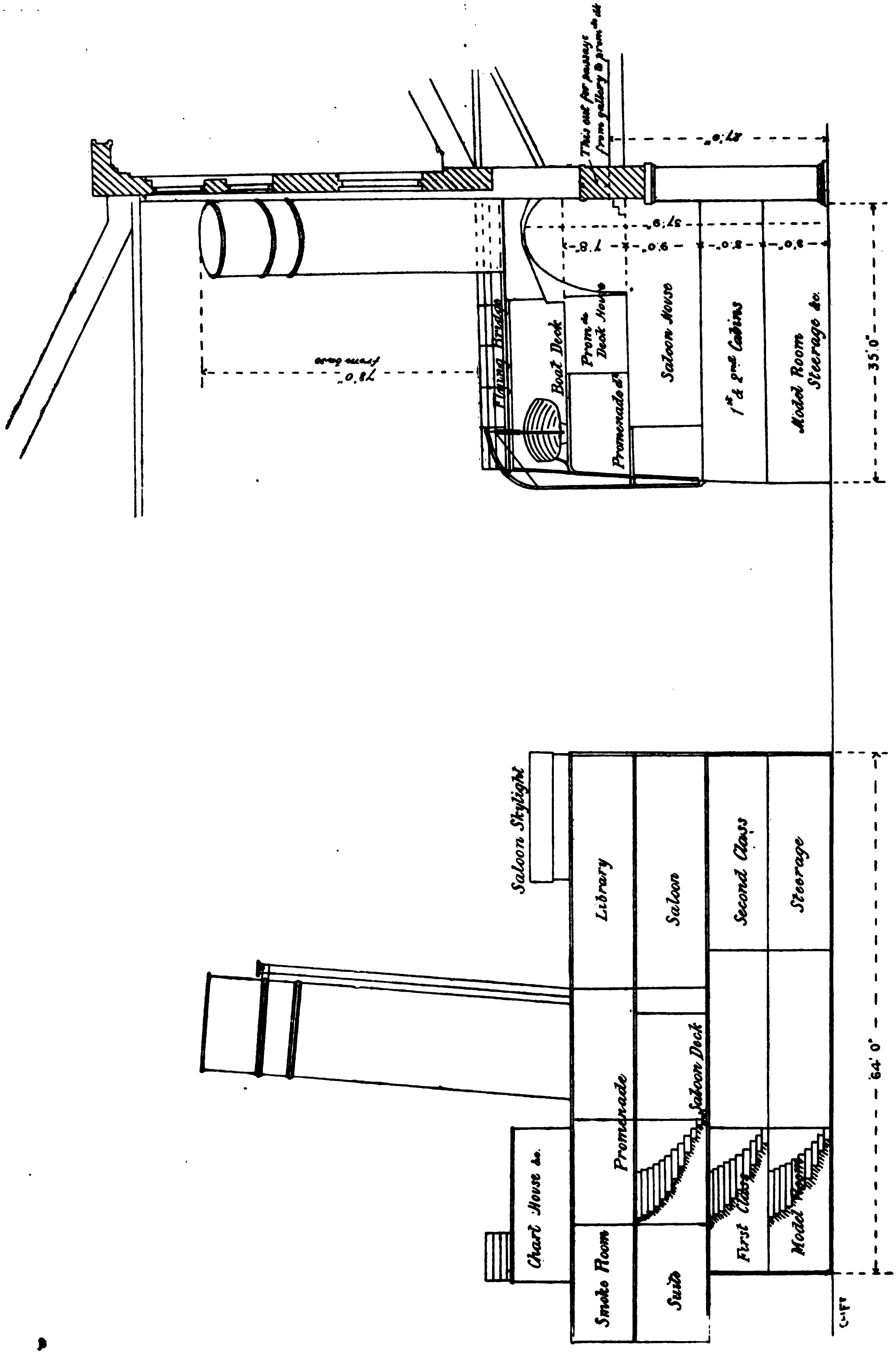
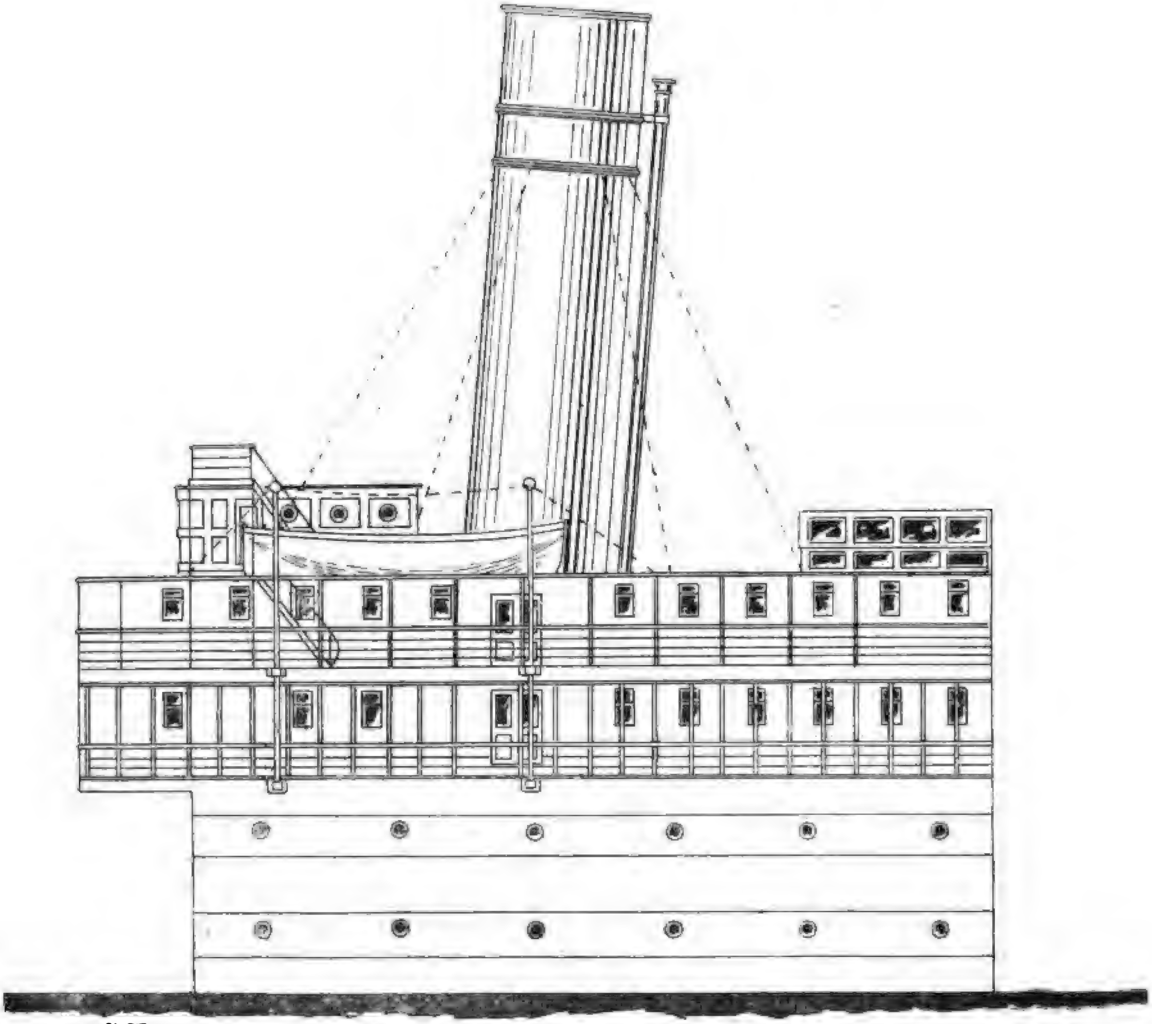


EXHIBIT OF THE INTERNATIONAL NAVIGATION CO. AT CHICAGO (*see page 240.*)

cluding the chairs and tables, is all of white mahogany, while the walls above the wainscot and ceilings are light sea-green panels, relieved by silver mouldings. But the most attractive feature of the room is the dome in the centre, through which the room is lit by sunlight during the day and electric light at night. This dome is an arch of glass panels, through which the light comes without obstruction, and the whole effect is most cheerful. Around the base of the dome and at one end are panels beautifully decorated with allegorical figures representing Commerce, and it is holstering being made to match. The panels are decorated with frescoes running around the room, and the ceiling is also artistically painted. The whole effect of this room is very beautiful and in good taste, and plainly shows that no expense has been spared in fitting it up.

On the deck above, which is the highest, and which is called the "promenade" deck, the cabin passengers spend most of the time while at sea, either smoking, reading or lounging about.

The house on this deck is divided as is the one on



supported by carved figures of Neptune and Mermaids. At the other end of this deck is a suite consisting of two rooms, the inside one being the bed-room and the outside the sitting-room. In the bed-room is double bedstead, a folding washstand, and a wardrobe. Opening into this room is a bath-room completely furnished. In the sitting-room are two sofas, which make up into four berths, if wanted, two washstands, a table, cupboards, seats, etc., in fact, everything that is needed in a well-appointed sitting-room and bed-room is included in this apartment. The decoration of the suite is in ivory-white and pink, all the up-

the saloon deck, into three spaces. The hall around the stairs, or as it is called in a ship, the companion-way, is the same size, and is finished as is the one below, in mahogany and gold.

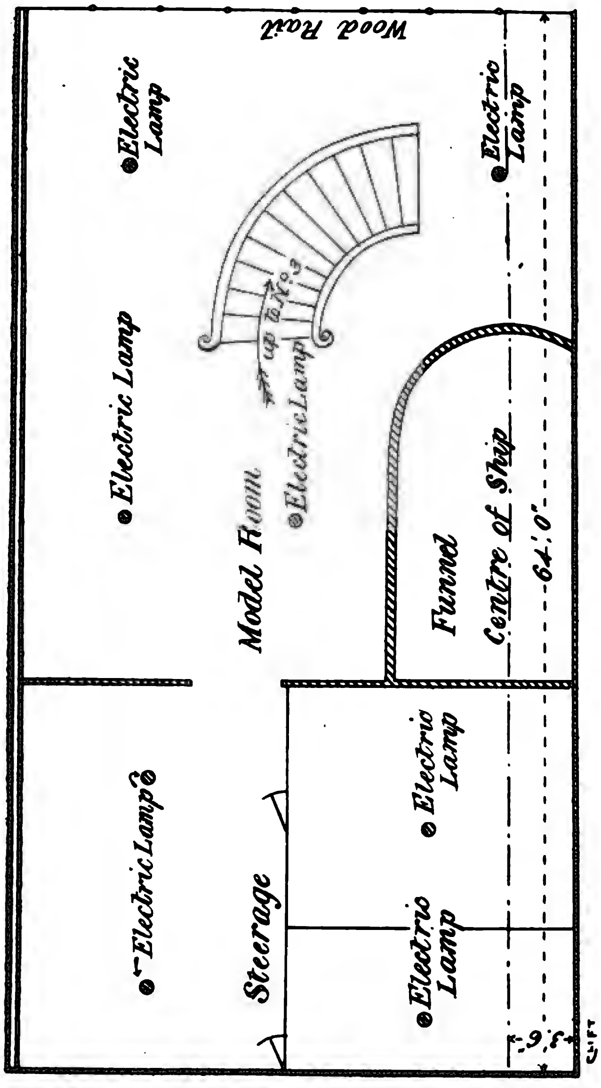
On the promenade deck is the library. In this room the woodwork is red mahogany, the walls are dark red and the ceilings are gold. There are seats running along the outside wall, upholstered in dark plush, and tables to write on the inside. This room as well as all the rooms on the two upper decks are lighted by large square windows, with small ventilating windows above. At night the large windows are

H.M.S. "RESOLUTION," BUILT AND ENGINED BY THE

SHIPBUILDING AND IRON Co., Ld., JARROW-ON-TYNE.

covered by a sliding sash of leaded glass, and electric lights are placed behind these so that the room is always lighted through the windows.

On this deck also is the smoking room, and it is finished with dark mahogany wood work, and smoke coloured walls and ceilings, relieved by silver mouldings. The seats arranged in the form of hollow squares with one side out, and a table in each square. The upholstery is of dark red leather, which is in keeping with the carved mahogany seats.



Having gone through all four decks of the exhibit, you can leave it by the way of the gallery, which runs around the building, as it is on the level of the promenade deck, and is reached by a few steps which lead into the hall of the deck-house on this deck.

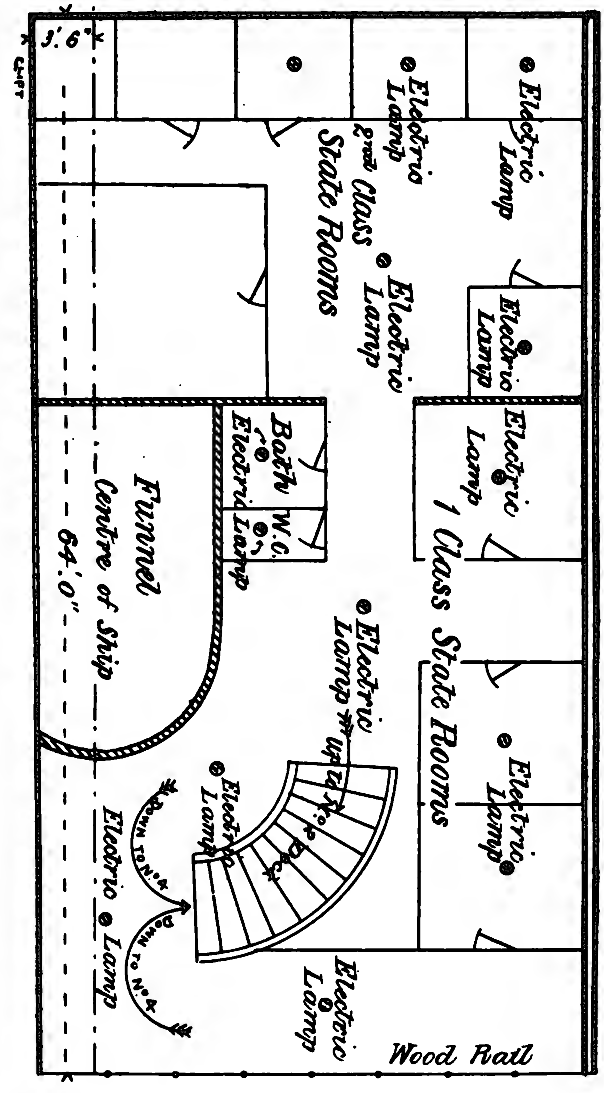
"STREDURA."

THIS is a new anti-friction metal, specially adapted for use in mechanical and other operations. It can, we understand, be used with great advantage in all kinds of marine and other engines, for main and other bearings, being hard and durable, having a high resistance against the action of sea water, acids, &c., and superior to any other copper alloy. It is malleable, and can be cast in any form or shaped to any device, thus rendering forging unnecessary. The alloy can be supplied in castings, or ingots for same, in sheets, bars, or finished goods.

There are four grades of the alloy, viz., Nos. 1, 2, 3 and 4, recommended for the various purposes, according to the requirements as undermentioned.

No. 1 is specially adapted for bolts, studs, propellers, and blades (this especially, the metal not being subject to any action by corrosion or pitting, &c.), anchors, chains, rudders, propeller shafts, and other bolts.

No. 2 is principally adapted for shaft and other bearings in

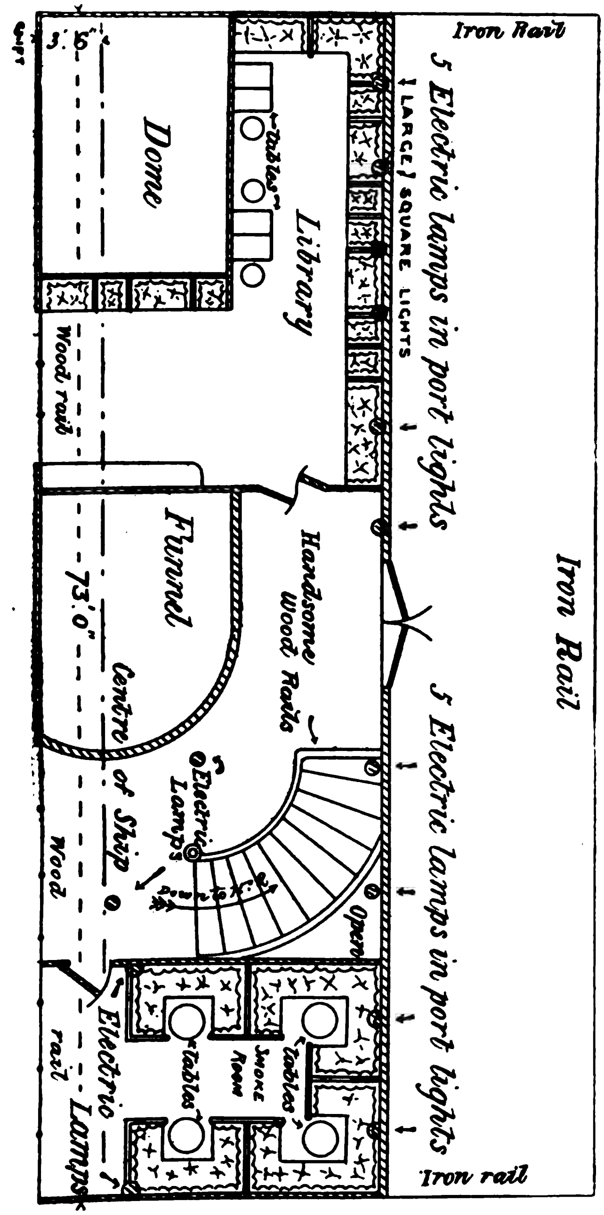


marine and other engines, more particularly where they are exposed to the action of water or weather; also for valves, pump rods, and buckets, rams for bilge and feed pumps, air and circulating pumps, rods, worms, and wheels of all descriptions, thrust block rings, all bearings for locomotive, stationary, electric, and other machines requiring this material.

No. 3 is harder than Nos. 1 and 2, and is used mainly for sleeves for propeller shafts, bushes in stern tubes, and as cylinder faces for slide valves, piston rings and piston valves, shoes on cross heads, bushes and liners for carriage axles, all parts of electric engines, and other high-speed motors where hard wear is required.

This alloy is very durable, and is impervious to any action by acids or by sea water; this is also supplied in ingots or casting.

No. 4. This alloy is a white metal for all anti-friction purposes, such as liners for bearings, thrust blocks and crossheads, propeller shaft bearings, and general uses. From the report of tests made by Professor Unwin on three specimens of this material, we notice that the results are as follows:—Tensile tests: sectional area of test pieces, ·6 square in., the stress at elastic limit of the three pieces was about 7 tons per square in., while the maximum ultimate stress was about 11·5 tons



per square in.; the elongation on 8 in. was about 12 per cent. In the torsion tests, the results with a maximum twisting moment of 4,265 lbs. ins., was that about 1·6 turns could be given to the specimens in a length of 6 in. before fracture.

Hohenzollern.—The German Emperor's new yacht, *Hohenzollern*, which has lately laid off Cowes, only completed her steam trials a week or so before she came to England. The results have just been published. Without employing forced draught, she developed 9,460 instead of the anticipated 9,000 ... and attained a speed of very nearly 22 instead of a little ... knots. During 24 hours' continuous steaming her mean ... 19·5 knots.

THE FLEETS OF THE MAIL LINES.

ONCE again we see that though it may be possible to get a stranded vessel afloat and safely docked, it is by no means always worth the labour and expense. It was so in the case of the *Eider* whose dismantling we referred to last month it is so in the case of the *Islam*. In the July number we spoke of the long continued efforts, at last crowned with success, to refloat her. Since then she has reached Liverpool, and the result has been that this vessel, which has not steamed a couple of thousand miles, is advertised for sale by tender.

The Board of Trade inspectors issued their report on the evidence taken in the *Naronic* inquiry on the 3rd of August. They find that as regards design, workmanship, stowage, and management, she was everything that we should expect her to be. They do not think her machinery could have been the cause of the disaster, they think that in the supposed place of her loss no ice could have been encountered, and the fact that one of the boats found had a sea-anchor out seemed to prove that she was not overwhelmed by any instant and fatal calamity, and they are fain to leave the matter without any expression of opinion as to the cause of her loss. They conclude their report in the words we ourselves used in the same connection—it is "a mystery of the sea."

The Cunard Line has begun a clearance of its antiquated vessels by disposing of the tender *Jackal* to a shipbreaker. That it has several vessels which are likely to follow her is apparent from the following list. Besides the vessels of the New York and Boston fleets, the line owns the

British Queen, built	1849	...	*Marathon*, built	1860
Atlas	,, 1860	..	*Kedar*	,, 1860
Morocco	,, 1861	...	*Tarifa*	,, 1865
Aleppo	,, 1865	...	*Palmyra*	,, 1866
Samaria	,, 1868	...	*Trinidad*	,, 1871
Cherbourg	,, 1874	...	*Saragossa*	,, 1874

Of course all these vessels were fitted with compound engines in the early seventies, and the *Aleppo* has comparatively recently had triples.

The rapid overhaul of the *Paris* on the Thames in July was partly accountable perhaps for the fast westward passage she has made. The record on the Southampton route had been previously held by the *Furst Bismarck*, but on this trip the *Paris* took it from her, lowering her time by about two hours.

Yachting matters do not generally fall within the compass of this column. But while no one will refuse our right to bring in the old mail steamers which now do duty as public pleasure ships, we are surely also entitled to bring in a private pleasure vessel owned by a limited company. We notice then Mr. Vanderbilt's new yacht the *Valiant*, which has been completed for him by the Birkenhead firm of Laird's at a cost of no less than £200,000. She is a twin screw-steamer of 2,500 tons and 4,500 I.H.P., she left the Mersey for Glasgow on the 3rd August. Her performance will be watched with interest. Magnificent as she is, and remarkable for size and comfort, there is a point as to her ownership which perhaps is more remarkable than anything else connected with her. She is owned by a newly registered company called by her name. Its capital is £100,000, and its subscribers are the builders, the millionaire and a few friends. She is to be worked for "pleasure only," and as long as he lives or continues to hold half the stock Mr. Vanderbilt is to be managing director. It is a queer arrangement, and a not very dignified way,—according to British notions,—of limiting the loss if accident occurs.

The Beaver Line *Lake Nepigon*, homeward bound from Montreal with passengers and cattle, has had a narrow escape. Passing through the Straits of Belle Isle she was holed by ice, and made water so fast that Captain W. H. Taylor had to beach her in the first likely spot. He sent for assistance, but realized that he must act for himself meanwhile, so the passengers were landed, and a pad was got over the hole, and inflow brought within the pumping power of the vessel, that being assisted by seamen who baled water and grain out of the damaged hold. He got her off, and when help came the *Lake Nepigon* was riding safely at anchor, while the heavy surf then running in the spot she had occupied showed that if he had waited the vessel would probably have been beyond saving. The underwriters at Quebec have rightly shown their appreciation of such seamanlike conduct.

The long-talked-of Canadian Atlantic service seems to hang fire still. Those who visited the Royal Naval Exhibition will

remember the model of a vessel proposed for the service there exhibited. It was shown by a line called by the high-sounding title of the Imperial Steam Navigation Co. But the matter remained at that stage. Now a rumour has been started and promptly contradicted, that the Clyde firm of Robert Napier & Sons have tendered for the contract. Possibly, though the exact facts may not have been stated, there is something in the rumour after all.

I went down to Tilbury Docks the other day and saw there two melancholy sights. The first was *La Plata*, formerly a Royal Mail boat, laid up for developments after her recent unsuccessful attempt at starting on a yachting trip. The other was the *Palais Royal*, the yacht of Mr. Wells, of Monte Carlo fame. She is there waiting for a purchaser, and is just as Wells left her. His clothes are even now hanging up in his private room. The vessel is perhaps better known to our readers as the Holt liner *Tycho Brahe*. The mark of that line's personality is all over the ship in spite of her alterations. She is steered by hand, and the engines are of the tandem compound type, having only one crank. There is only one boiler, though that is a large one. She is probably a cheap vessel to run even now. The features of the ship are the accommodation designed for the owner and his "niece." The latter's room being furnished regardless of expense. Forward of this, a large ballroom was being fitted when the crash came. Everything necessary to complete it is said to be on board, and there is certainly an immense assortment of stores about. The manner in which the deck had been cut to give this chamber the height of two decks is very noticeable.

The *Lucania* will, I suppose, be ready to sail as advertised, on the 2nd September, but arrangements as to trials and cruises have had to undergo considerable alteration owing to an unfortunate accident which occurred to her when coming round to Liverpool for scraping and painting previous to her full speed trials. She encountered some hard substance, which, without breaking any plates, caused a number to be dented and so they were removed to be put into shape again. Thus she will not get out of the graving dock till the 26th, and will not have too much time to get ready for her first voyage.

August has seen two fine mail steamers added to the mail fleets of the narrow seas, the *Marie Henriette* and the *Magic*. The are about as different in every particular as two modern steamers can be. Giving the stranger the pass, we find the *Marie Henriette* for the Ostend service, built by the Cockerill Co. of Antwerp, almost an exact reproduction of the *Leopold II.* built for the same service by Denny's of Dumbarton and launched by them on the 22nd December, 1892. Both are 340 ft. long by 38 ft. beam and 15 ft. deep. Both were tried on the well-known course between the Cloch and the Cumbrae Lights, and the contract speed was 21½ knots. The Scotch-built ship did 21·955 knots, and the Belgian 22·2 knots. By this performance the Cockerill Co. gets a premium of £4,000. Being built for a Government service economy seems little object, and so the Ostend boats adhere to the paddle. The other vessel we refer to is the *Magic*, a twin-screw steamer built by Harland & Wolff, for the trade between Liverpool and Belfast. The vessels of this line have long been known to channel passengers as the White Star boats are to travellers on the Atlantic. Indeed the arrangements are much the same in both fleets, and as the Belfast line sails at night one wakes in the morning near one's destination and in the moments between sleeping and waking is apt to fancy one's self in a stateroom of an ocean liner, for the little rooms are quite private, and the lavatory, lighting, and cabin arrangements generally are equal to those of most ocean boats. This vessel having no government behind her has to trade on strictly commercial principles, looking to the good name she can make for herself and to maintain that already acquired by her sisters, and so she has the twin-screw. We venture to think that regularity and freedom from breakdowns will be more remarkable in her case than in that of the old-fashioned Ostenders, who did not get through their trials altogether without mishap.

As hardly anyone seems to want to get to Chicago and all the means of getting thither are neglected, we have been greatly overdone with information as to how to get there. The *English Illustrated* and the *Daily News* told us of the facilities for getting there in April, and now in August the *Strand Magazine* is telling us about one of their contributor's travels from London to Chicago. We, however, recommend our readers to get the number because it has some capital illustrations of the *Majestic*, some of which were and some of which were not produced in the *English Illustrated* article. We are, however, rather surprised to see that a prosperous concern like the *Strand* condescends to reproduce blocks from the gratuitous fly sheets circulated by the Pennsylvania railroad.

I am getting quite afraid of taking up a newspaper. In our last issue I spoke of the way the s.s. *Khiva* pursued me. On the 15th August I took up the *Shipping Gazette* to read with my evening meal. I dropped it with a start. There was the abstract of the finding of the court of inquiry into the loss of the *Khiva* again which had appeared in full in the same paper some seven weeks previously (to be exact it was on the 21st June). I took refuge in the *Evening Standard*. It was there too. When is this historic calamity to be allowed to take its place in history and cease to come before us as news?

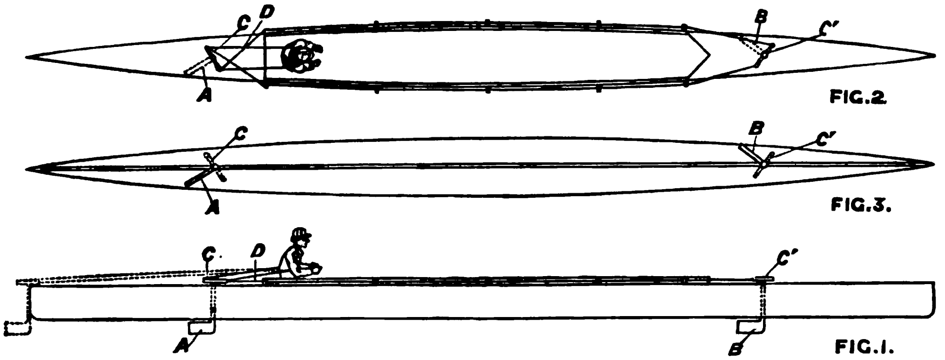


FIG. 2.

FIG. 3.

FIG. 1.

STEERING GEAR.

IN the adjoining illustrations we show the arrangement of rudders and connecting apparatus therefor, which has been proposed by Mr. Wethered, of Great Marlow. The invention is applicable to racing or other boats, sailing or steamships, barges, or any kind of vessel in fact, and has for its object the provision of means whereby the boat or ship may be caused to turn more readily and promptly to answer its helm and to turn in a circle of smaller radius than can be effected by the usual rudder. To effect this result, a supplementary rudder is carried at the bows of the boat and is connected to the stern rudder so that they act simultaneously with one another and at opposite angles to the keel. The diagrams clearly show the idea as to how it is to be carried out in small racing boats and steamers.

Cargo-boat.—The Naval Construction and Armaments Co., Barrow-in-Furness, have received an order for a cargo-boat for a Liverpool firm.

STOCKLESS ANCHORS IN SAILING SHIPS.

In spite of the fact that stockless anchors have been largely adopted for steamships, the owners of sailing vessels in this country have, up to the present, shown no disposition to discard the old fashioned and cumbrous stocked anchor in favour of the modern, and admittedly more effective type. Whether this is due to economical considerations or to the eminently British characteristic of a dislike to innovation, we are not in a position to say; but whatever the cause the fact remains that a distinct improvement upon old methods in connection with a most important particular in ship equipment, appears to be regarded with indifference by the class of owners referred to. A circumstance has recently occurred however, which may serve to rouse them from their apathy, or at all events to excite a spirit of enquiry in their minds in regard to this matter. This is the adoption by a French firm (H. Prentout, Leblond & E. Boniface) of Tyzack's "Patent Triple Grip" anchor in three of their largest sailing ships, each having a register tonnage of 1,148 tons. It appears that the captains of the vessels in question objected to the adoption of this type of anchor, on the ground that it would not afford the same amount of holding security as the ordinary stocked anchors; but the owners, believing the objections to be founded on mere prejudice, overruled them, and the results have eminently justified the soundness of their judgment. In actual work Tyzack's "Triple-Grip" has been found much more reliable than anchors of the ordinary type. As an illustration of this, it may be stated that the firm of French owners re-

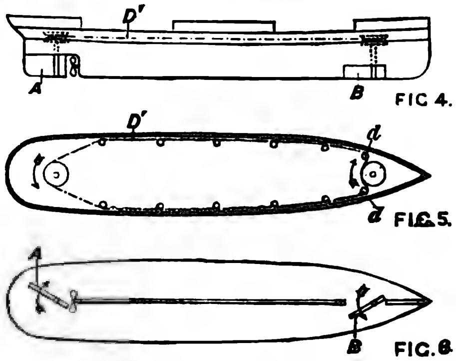


FIG 4.
FIG. 5.
FIG. 6.

ferred to above, have informed Mr. Tyzack that during a gale in the Pisagua Roads, when other vessels were forced to cast second anchors, a vessel of theirs held the ground without drifting, with only a single anchor of the "Triple-Grip" type. The captains of this fleet who had opposed the introduction of Tyzack's anchors, are now, after the experience gained, very earnest in expressing their approval. This firm is, we believe, the first who have equipped sailing ships with this type of stockless anchor, which has proved so well adapted to the requirements of steamers, and considering the success of the experiment, it will be strange indeed if their example is not largely followed. In this notice we have given prominence to the experience of the French firm, mainly because it relates to the use of the "Triple-Grip" in sailing ships, which is, as we have noted, a new departure; but numerous cases might be cited, in which the superiority of this anchor has been demonstrated when used in steamers. Messrs. Wilson of Hull have fifteen of their largest steamers equipped with them, and the "Hansa" Co. of Bremen have an equal number of vessels fitted; the experiences of both firms being, as stated in the reports of their superintendents, that the anchors are in every way to be commended, possessing extraordinary holding power, while being at the same time exceptionally convenient for stowing and handling. The distinctive feature of the "Triple-Grip" is the presence of a central arm, which steadies the action of the anchor by taking the strain upon it in a direct line from the cable, as in ordinary anchors, the resulting effect being that when holding, three palms take the ground simultaneously instead of only two. It is scarcely necessary to add that greatly increased holding power is thus secured. The anchor besides having the merits already pointed out, is simple in construction, moderate in cost, and can be worked into an ordinary-sized circular hawsepipe. We are pleased to be able to state that the popularity of this anchor is rapidly increasing, a fact which is fully proven by the numerous orders coming to hand daily, among the most recent being one from the Danish, and one from the Austrian Government. It may be added that the latter Government have a number of vessels fitted with Tyzack's anchors.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our own Correspondent.)

The End of the Manœuvres.

The manœuvres are over, and their chief lessons are dealt with elsewhere in this issue. The ships have returned to port, paid off, and are once more placed in the Fleet Reserve. Will the officials of the Reserve benefit by some of the minor defects which the operations have revealed? It seems doubtful, because each succeeding year the same or similar shortcomings are apparent, and hitherto with no very apparent resultant advantage. Perhaps the officials are not altogether to blame that when these vessels left in their care are needed for sea they are found in so many ways to fall short of expectation. Without men to keep the ships predie, their machinery in working order, their guns free from rust, and their boats from leaks, the officials can do little; it may even be to their credit that they do so much. But why should there be a lack of men? It has been proclaimed by the Naval authorities over and over again that each ship is to have a skeleton crew of one-third her complement, none too many to keep her in order, and if these skeleton crews are not appointed or allocated from the depôts someone should be to blame. Is there or is there not a scarcity of seamen and stokers? If there be, then the executive and engineer officers should complain and complain loudly, too, for depend upon it when the stress of war comes it will not be on the shoulders of the Dockyard officials that the public wrath will be visited.

Engineer Organisation.

The engineers have an organisation which has won for them much amelioration of the hard conditions under which they serve the country. The result of their organisation and its agitation is very obvious. Never more so, perhaps, than in the correspondence which has recently taken place between certain engineering members of the House of Commons and the First Lord of the Admiralty. That which no other class of officers in the Navy can do they can do, and although not with exactly the result at present that they are aiming at, still with sufficient success to justify them in going ahead. The expostulation of the five eminent engineers and Members of Parliament who represent the Naval engineers is concerned with the subject of the alterations recently made by the Admiralty in engine-room complements which indirectly affects the engineers by seriously impairing, in their opinion, the efficiency of their department. They complain of the reduction in men and of the change in the constitution of the complements, and they further say that these reductions and changes have rendered the Naval Service less attractive to highly trained mechanics and engineers. They give at length the grounds on which they have arrived at this conclusion, and reasonably argue out the matter in a way which is plain to common sense. Finally, they ask for an exhaustive enquiry into the questions raised, believing that the present state of affairs constitute a grave and national danger.

The Roseate view of Officialdom.

In his reply, says a well-known and most capable naval engineer, the First Lord of the Admiralty has to a certain extent "given himself away." He says that the changes which have been carried out during the last two years were the outcome of a most painstaking inquiry on the part of a body of experts, in whom the late Board had the greatest confidence. This confidence was certainly not shared by the seagoing engineer officers of the Navy, and it was indeed impossible that it should be. The body of experts practically included four naval engineers. The Engineer-in-chief, the chief engineer of Portsmouth Dockyard, and, immeasurably senior to both of them, Chief Inspectors of Machinery, Heffernan and Castle. These last two have not served afloat since the Egyptian War of 1880, but the first mentioned were only at sea for comparatively a short period at double that distance of time, and neither of them were ever in charge of machinery. What can the opinion

of any of the four be worth as to the numbers and qualifications of the *personnel* of a modern engine-room?

THE OUTCOME OF ADMIRALTY INQUIRY.

The First Lord says that the substitution of chief stokers for engine-room artificers has only been carried out in those cases in which actual experience has shown that the change would be beneficial; but he does not say where or by whom this actual experience was gained. No one denies that chief stokers are valuable, useful men; but they are not valuable as substitutes for engine-room artificers, for they are incapable of doing the work of the skilled men. Just as well might the Naval authorities attempt to replace the captains of their men-of-war by the masters of merchantmen. The First Lord also states that he has received reports from some of the ships to which the new scale of complements has been applied and these reports are satisfactory as to the sufficiency and efficiency of the new engine-room complements. Then why not make public these reports, and allow the country, the real arbiter in the case, to judge of the value of these reports for itself. Lastly, Lord Spencer pleads for delay. It is the old official excuse, and has never yet been put forward except to blind the nation, which unfortunately cannot be made to keep its eyes on one subject for long. But the engineers are not yet at the end of the resources of agitation, and the question is one which will crop up again shortly.

THE SCARCITY OF NAVAL ENGINEERS.

In the matter of the lack of engineers, which is another point dwelt upon, it is odd to see the shifts to which the Admiralty are put to hide the real condition of affairs. In answer to Mr. Jeffries, M.P., who asked whether the Navy was short of fleet and staff engineers at present, the Secretary of the Admiralty said that taking the question to relate to fleet, staff, and chief engineers, which grades are reckoned together for all purposes, the number is not short. The limit, which was two hundred and fifty, is to be raised by ten promotions in each year to two hundred and eighty. But, as has been pointed out, the Navy List gives the total of officers of these three grades at one hundred and forty-nine. The process then of raising is not yet in working and meantime the present limit is admittedly too low. Moreover, how is it that in the Navy List we find no fewer than twenty-seven ships whose machinery is supervised by an engineer "in lieu of a chief engineer." If engineers are appointed "in lieu" does it not point to a scarcity in the higher grade? Moreover, why is it that some ships carry an engineer and others precisely similar in every respect carry an engineer "in lieu"? Manifestly there is a mystery here, and what but that scarcity which is to be supplied by three years "raising" is accountable for it?

CHATHAM DOCKYARD.

Two ships have been completed at this yard in the past month, and will be shortly commissioned. The *Empress of India*, built at Pembroke, and launched in May, 1891, by the Duchess of Connaught, is said to be the most cheaply constructed of her class, her cost being £920,000. The second ship is the first-class cruiser *Grafton*, built by the Thames Iron Works Co., she has recently passed satisfactory trials, and her machinery has been accepted from the contractors. The *Theseus*, a sister ship, arrived here on the 14th August, and is now to be taken in hand for completion, the time fixed for her readiness for sea being October next. In the same month the gunboat *Dryad* should be ready for launching. The next ship ready for trial will be the first-class battleship *Barfleur*, engineered by Messrs. Scott, of Greenock; work on the *Howe* is being carried on night and day, and she is to be ready on the anniversary of her namesake taking the ground. Engines and boilers for the ship are being repaired here. We also expect soon to lay down the first-class battleship *Magnificent*, of this year's programme, but before this can be done the Alexandra slip will have to be increased to 75 ft. width to accommodate her; the work is already in hand. The *Agincourt* is being renovated, and is to be supplied with new boilers. The *Medea* has been passed into the Fleet reserve, the *Hydra* and *Slaney* are having their under water fittings looked to, and the troopship *Tyne* is being repaired at this yard.

COMMISSIONS AND RECOMMISSIONS.

The *Empress of India* is to take the place of the *Anson* in the Channel Squadron in the coming month, and will hoist the flag of Rear Admiral Seymour. The *Ramillies*, a sister ship, at Portsmouth, has just completed her gun trials, and she will take the place of the *Rodney*. The Channel Squadron will then include three ships of the *Royal Sovereign* class. The *Immortalite*, also of this squadron, will be relieved shortly, and probably by the *Grafton*. The *Anson* and *Howe* when ready will go to the Mediterranean, the first as the relief of the *Colossus* and the second as that of the *Edinburgh*, these vessels when they arrive home going into the Coast Guard reserve. The *Phæton*, which returned to Devonport on August 7th, has been paid off, her decks needing repair, but her machinery was reported in capital order. The *Magicienne*, which arrived at Portsmouth on the 6th August, is also paid off, and has been recommissioned for another term of service on the North American and West Indian Station. The *Warspite* will relieve the *Triumph*, the *Wild Swan* is to relieve the *Garnet* in the Pacific, and the *Ajax* will probably go to China, to take the place of *Victor Emmanuel*, the guardship at that port. In a similar way the *Nelson* will go to Malta presently, to act as the sea-going guardship at that dockyard.

PORTSMOUTH DOCKYARD.

Since the arrival of the *Resolution* no other ship has been delivered here, but the *Revenge*, a sister vessel building at Palmer's, is expected shortly. It is proposed to lay down the new second class cruiser *Eclipse* here next October, and the work of laying off has commenced. The *Endymion* has made a trial, and unfortunately not without a mishap. A dredger having run into her and knocked some of her plates about. The trials, however, were satisfactory so far as they had taken place. Work is progressing on the *Centurion* and also on the *Sultan*, while the *Devastation* and a couple of troopers are under repair. It is to be feared that the scare created by the loss of the *Victoria* will be utilised as an excuse for not hurrying the construction of the *Majestic*, the new first-class battleship promised to this yard. In fact, it would not be surprising if there was a regular postponement of battleship building until after an enquiry into the stability of our present battleships. The plans of the *Majestic* have, however, been received, and the work of laying off will therefore soon commence. The contract for building two new docks here 600 ft. long has been awarded to Messrs. Price & Sons, of Westminster, but the sum allotted for this year's expenditure does not promise their speedy fulfilment.

THE "BONAVENTURE" TRIALS.

The *Bonaventure*, a new second class cruiser of the *Astræ* class has been undergoing her trials at Devonport, and with great success. This ship is engined by Messrs. Hawthorne, Leslie & Co., who are also builders of machinery for the *Cambrian* and *Sybille*. She was launched in December last by the Princess Marie of Edinburgh, and is the first of her type to make her steam trials. At an eight hours natural draught trial on August 23rd the estimated H.P. of 7,000 horses was exceeded by 340, while the anticipated speed was also attained and something over. The results were as follows:—Mean steam in boilers, 149 lbs.; air pressure, 0·44 of an inch; vacuum, starboard 27, port 26·6; revolutions, starboard 133, and port the same. The total I.H.P. was 7,340, and speed by log 19 knots. On the 24th and 25th further trials were made, and a four hours run with moderate forced draught gave a speed of 20 knots. The draught of water has not been given in the record, but presumably the ship was at her normal load line, and if this is so the *Astræ* class of cruiser will most likely prove as satisfactory as their predecessors of the *Apollo* type.

SHEERNESS DOCKYARD.

There will be plenty of work, looking to the defects of our torpedo gunboats, if, as is possible, they are sent here for repair. The *Niger*, one of the new 810 ton boats, was rapidly fitted out here to take the place of the *Jaseur*, and it is inexplicable that on active service she should have been able to realise the speed attained on trial. The *Jaseur*, turned out by the same firm, the Naval Construction Co., of Barrow, had to be put on the shelf because of a defective cylinder, but it is to be hoped these boats are not to be in the same category with the *Shelldrake* and *Salamander*. The trials of the *Renard* and *Leda* will take place very shortly, those of the latter having been unsatisfactory on the last occasion. After these we have the *Hebe*, engined by this yard, and the *Speedy*, which is to be delivered from Messrs. Thorneycroft's. All these are 810 ton boats, but the last named has a tubulous or water boiler from which great things are expected. The two new station sloops *Torch* and *Alert*, which are to be built and engined here, will be begun soon, but as only about £25,000 is allowed for them in this year's Estimates, they cannot make much progress. They are intended for the Chinese rivers, and will steam about 10 knots. Other work in hand here is the alteration of the old *Forte* frigate into a coal depôt, and the old gunboats *Frolic* and *Drake* into coastguard watch vessels.

The New First-Class Battleships.

Detailed description of the two first-class battleships *Majestic* and *Magnificent*, which are to be built at Chatham and Portsmouth, have now been published for the information of Parliament. The sum of £179,500 will be expended on the construction of the *Magnificent*, and £81,900 on that of the *Majestic* between now and April next. The principal dimensions of these vessels are:—Length, 390 ft.; extreme breadth, 75 ft.; mean draught, 27½ ft.; displacement, 14,900 tons. With natural draught a speed of 16¾ knots is anticipated, with moderate forced draught a maximum speed of 17½ knots. The armament will include four 12 in. new type breechloaders, mounted *en barbette* in pairs, but covered with a shield and capable of being worked with hand power. The secondary battery will be twelve 6 in. quick firers, sixteen 12-pounder quick firers, another new type, and twelve 3-pounder quick firers. There will also be five torpedo tubes for discharging 18 in. new pattern torpedoes carrying 2,000 lbs. of gun cotton each, and four of these tubes will be under water. The coal stowage at normal load draught will be the same as the *Royal Sovereign* class, *i.e.*, 900 tons, but they will have more bunker space, and so, if it be desired, can carry more fuel. The distribution of armour and its thickness in the new ships is not disclosed, but it is an open secret that it will be very similar to that of the *Renown*, namely a longer belt, possibly enclosing the barbettes, a high citadel with all the larger kinds of quickfirers in casements. Although the change of 12 for 13 in. guns means a saving in weight, the load to be carried by the new ships is proportionately greater than that of the *Royal Sovereign* class, and therefore their displacement is heavier, which means, especially as they are practically of the same speed, more horse power, but as yet no definite information on this head is vouchsafed.

Devonport and Keyham Yards.

These yards were fully engaged all through the manœuvres with one breakdown and another. First the torpedo boats contributed a contingent, then the *Melampus* cruiser came in hand with several defects, and after her the gunboats *Speedwell* with leaky boiler tubes, the *Salamander* and *Shelldrake* with leaky condenser tubes and the *Gossamer* with her hull leaking through straining in a heavy sea. The *Astræa* cruiser is nearly ready for trial, the *Antelope*, engined by Messrs. Yarrow, is also preparing to make her essays. The *Hermione* cruiser engined by Messrs. Thompson is to be ready for launching November 9th, and the *Harrier*, *Halcyon*, and *Hussar* are well under weigh. Ships repairing in hand are the *Warspite* at Devonport and the *Undaunted* and *Himalaya* at Keyham, while now we have the *Forth*, which is badly damaged by collision with a merchantman. In the port bow are several holes, two them below the protective deck and in the starboard bow there are also two holes but not so large as those on the other side. The holes were caused by the ram being twisted over to port and in consequence forcing rivets out here and there in the plating. It is considered probable that the 24 ft. ram will have to be removed and replaced by a new prow. The damage to the merchantman was also considerable, and it is a wonder that with a hole, 6 ft. square at its maximum width and 25 ft. in length, in her midship compartments she did not go to the bottom. The *Forth's* ram went into her to a depth of 22 ft.

Launch of the "Havock,"

On August 12th Messrs. Yarrow launched from their yard at Poplar a new description of small craft of which the official designation is "torpedo-boat destroyer." There are six of these vessels under construction, the *Havock*, the vessel just launched, and the *Hornet* at Messrs. Yarrow: the *Daring* and the *Decoy* at Messrs. Thorneycroft's; and the *Ferret* and *Lynx* at Messrs. Laird's. They are of 215 tons displacement, 180 ft. long, and with 3,600 H.P. are to attain a trial speed of 27 knots an hour. For armament, they carry one 12-pounder quick-firer, three 6-pounder quick-firer and three 18-inch torpedo tubes. All these vessels are to be delivered before April, 1894, and the *Havock* should make her trials in October.

Gaseous Vapour in Oil Steamers.—Messrs. Donkin & Co. (late Donkin & Nichol), of the St. Andrew's Engine Works, Newcastle-on-Tyne, have made a speciality of the manufacture of "enclosed fans and engines" for exhausting the gaseous vapour which forms in the tanks of oil steamers after the cargo has been discharged, and have now in hand a number of these engines for shipbuilding firms on the Tyne, the Clyde, and at —— centres.

H.M.S. "RESOLUTION."

We illustrate in our double-page supplement H.M.S. *Resolution*, of which we gave a full description in our last number.

The dimensions and particulars of the *Resolution* are as follows:—Length, 380 ft.; breadth, 75 ft.; draught mean, 27 ft. 6 in.; displacement, 14,150 tons; freeboard forward, 19 ft. 6 in.; freeboard aft, 18 ft.; I.H.P. forced draught, 13,000; I.H.P. natural draught, 9,000; speed forced draught, 17½ knots; speed natural draught, 16 knots; coals carried at a designed load draught, 900 tons. The construction of the ship has been made exceptionally strong. She is built entirely of steel, the stem, sternpost rudder and shaft brackets being formed of cast steel.

The Shipbuilding Trade.—In his monthly report to the members of the United Society of Boilermakers and Shipbuilders, Mr. R. Knight, the general secretary, says:—The improvement mentioned in our last report has been maintained, and some of the yards that were closed at the back end of last year have been re-started, or are about to be so; and in the case of more than one of the really well-known firms work is plentiful, and was never more risk than it is at the present time. These firms form, of course, the exception; but the circumstance may be mentioned to show that, at any rate, some yards have resumed something like their former activity. There are still, however, many vacant berths, and until these are filled the trade cannot be regarded as being in a flourishing state. It is something pleasing, however, to note that more men are being engaged weekly, and that some builders have a good many orders in hand. Some of these are for ships that were ordered last year, but the orders were suspended until suitable partnerships could be found. The thing that was impossible last year has turned out, it appears, possible this; and it is a sign that there is more confidence in the shipping trade than was to be found six months ago. The fact is that modern steamships, such as those now produced, are got up on a most economical scale, and have been found to pay even at remarkably low rates. They have paid where ships built a few years ago have failed to yield a dividend, and it is this that may be said to be leading to present speculation, coupled with the cheapness of material and reduced wages. No doubt the great strike in the coal trade may check many industries, ours amongst the number, unless a speedy settlement is arrived at. It is impossible at present to even guess at the duration of the strike; it may become a question of endurance, and possibly a compromise. We are glad to state that trade still continues to improve in the various districts, and that on the Tyne some good orders have been secured by builders, which we trust in a short time will be the means of employing a large number of our members who are at present idle. We are also pleased to note that some improvement has taken place in the Clyde shipbuilding and marine engineering trades since last month. The tonnage launched during the past month has been exceptionally large, being 37,000 tons, as against 29,500 in July, 1892. The work on hand and recently contracted for represents a gross tonnage of 192,000, compared with 177,003 at the same date of last year.

Some new Ocean Flyers.—The American Steamship Co., the owners of the *Paris* and *New York*, has just been practically reorganised at Jersey City, New York. The new company is called the International Navigation Co., under which name the certificate of its incorporation was filed, the capital being fixed at 15,000,000 dols., in 100 dol. shares. The incorporators are C. A. Ericson, Wm Henry Barnes, A. J. Casal, and Henry H. Howison, of New York, Joseph Potts, of Philadelphia, and senator W. J. Sewell. The company will have a controlling interest in the American and the Red Star Line. Mr. Sewell said that the Cramps, of Philadelphia, had their order for five new ships altogether, and these will, with the *Paris* and *New York*, make a fleet without a peer. Each of the new vessels is estimated, he said, to cost 2,000,000 dols.

Patent Rope.—Messrs. Latch & Batchelor, of Hay Mills, near Birmingham, have received an order for 350 tons of their patent rope, to be used for the new towage system on the river Rhone.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from July 26th, 1893, to August 25th, 1893:—

Agnew, Thomas, staff engineer to the *Triumph*, to date August 29th.

Ash, Herbert G. (probationary), assistant engineer to the *Crocodile*, to date August 2nd.

Austen, Edwin J., chief engineer to the *Widgeon*, to date June 10th.

Austen, E. J., engineer, has been promoted to the rank of chief engineer in Her Majesty's fleet.

Benn, Edward P. St. J. (probationary), assistant engineer to the *Euphrates*, to date August 2nd.

Bermingham, Cecil W. A., assistant engineer to the *Victory*, (supernumerary), to date August 5th.

Blakeman, Mark, engineer to the *Malabar*, to date August 23rd.

Brown, Arthur (probationary), assistant engineer to the *Serapis*, to date August 21st.

Brown, William J., chief engineer to the *Charybdis*, to date July 28th.

Burner, Alfred, assistant engineer to the *Sans Pareil*, to date August 2nd.

Burstow, Hugh, fleet engineer to the *Conquest*, to date July 26th.

Carnt, Edwin C., chief engineer to the *Victory*, additional, for drawing office, to date June 23rd.

Carnt, E. C., engineer, has been promoted to the rank of chief engineer in Her Majesty's fleet.

Cook, H., staff engineer has been placed on the retired list of his rank.

Curtis, F. T. W., chief engineer to the *Hussar*, to date August 29th.

Curtis, F. T. W. engineer, has been promoted to the rank of chief engineer in Her Majesty's fleet.

Curtis, F. T. W., engineer to the *President*, additional, to date July 21st.

Dawson, Frederick G., engineer to the *Warspite*, to date August 29th.

Downer, John W., engineer to the *Seahorse*, to date August 11th.

Featherston, W. J., chief engineer to the *Pembroke*, for the *Circe*, to date May 7th.

Featherstone, Walter J., chief engineer to the *President*, additional, to date August 29th.

Featherstone, W. J., engineer has been promoted to the rank of chief engineer in Her Majesty's fleet.

Gedye, Henry A., acting engineer to the *Cambrian*, to date August 21st.

Gorfett, G. J., engineer, has been promoted to the rank of chief engineer in Her Majesty's fleet.

Gorfett, George J., chief engineer to the *Hearty*, to date July 16th.

Graham, James E. D., chief engineer to the *Hydra*, to date July 28th.

Graham, J. E. D., chief engineer, has been advanced to the rank of staff engineer in Her Majesty's fleet.

Hall, R., fleet engineer, has been placed on the retired list, with permission to assume the rank of inspector of machinery.

Herbert, Robert K., engineer to the *Victory* (for the *Hazard*, in lieu of chief engineer), to date August 11th.

Hockey, S., engineer, has been promoted to the rank of chief engineer in Her Majesty's fleet.

Hockey, Stephen, chief engineer to the *Grasshopper*, to date July 23rd.

Houghton, Sidney A., engineer to the *Sans Pareil*, to date August 26th.

Hulford, Charles F., fleet engineer to the *Vivid*, additional, for service in the reserve, to date July 26th.

Johnson, John E., chief engineer to the *Pembroke*, for the *Gossamer*, to date July 1st.

Johnson, J. E., engineer has been promoted to the rank of chief engineer in Her Majesty's fleet.

Legate, William P. (probationary), assistant engineer to the *Polyphemus*, to date August 2nd.

Marvack, Philip, engineer to the *Himalaya*, to date August 12th.

Mayston, R., staff engineer has been advanced to the rank of fleet engineer in Her Majesty's fleet.

Morgan J. T., fleet engineer has been placed on the retired list of his rank.

Norgate, Robert S., chief engineer to the *Nymphe*, to date July 26th.

Palmer, Alfred, fleet engineer to the *Warspite*, to date August 29th.

Pill, Joseph H., chief engineer to the *Circe*, to date August 29th.

Rawlingson, Walter H. H., engineer to the *Vivid*, as acting assistant to chief engineer, for charge of drawing office at Devonport Yard, to date August 12th.

Robins, S. J., staff engineer has been advanced to the rank of fleet engineer in Her Majesty's fleet.

Rock, Herbert E. (probationary), assistant engineer to the *Malabar*, to date August 2nd.

Rudd, C., staff engineer, has been advanced to the rank of fleet engineer in Her Majesty's fleet.

Ryan, James, engineer to the *Vivid* for the *Ferret*, in lieu of chief engineer, to date August 11th.

Spalding, Andrew, fleet engineer to the *Pembroke*, for the *Theseus*, to date August 11th.

Stewart, William F., chief engineer to the *Sandfly*, to date June 1st.

Stewart, W. F., engineer, has been promoted to the rank of chief engineer in Her Majesty's fleet.

Wells, F. W., engineer, has been promoted to the rank of chief engineer in Her Majesty's fleet.

Wells, Frederick W., chief engineer to the *Victory*, for the *Barrosa*, to date May 7th.

Westaway, A. E. L., engineer, has been promoted to the rank of chief engineer in Her Majesty's fleet.

Westaway, A. E. L., chief engineer to the *Spanker*, to date August 1st.

Wigins, William T., engineer to the *Vivid*, for the *Harrier*, in lieu of chief engineer, to date August 11th.

HOAR & BROWN'S HARDWOOD MARKET REPORT, AUGUST 23rd, 1893.

Teak—	TIMBER. Loads.	PLANKS. Loads.	BLOCKS. Loads.	TOTAL. Loads.
Stock, 1st August, 1893	6,964	2,885	26	9,875
Landings	Nil	96	Nil	96
	6,964	2,981	26	9,971
Deliveries	516	178	Nil	694
Stock, 23rd August, 1893	6,448	2,803	26	9.277

There is little that is new to report, deliveries being still very small, comparing somewhat unfavourably with those of August last year. The quantity of wood afloat available for the open market is exceedingly limited, but the disquieting element is the want of demand. Should there be any small improvement in this direction, it must have the influence of advancing the present low figures.

There are some indications of revival in the shipbuilding and railway industries which may help to strengthen prices.

Several parcels of planks have been sold, and it would appear buyers have realised the fact that prices have now touched bottom. Should the imports continue to be as small as they have been of late, there is no doubt quotations will quickly advance, though the stock is still very heavy.

MAHOGANY.—Business remains dull, owing, no doubt, to the holidays. The demand for good wood of all sizes continues to be satisfactory, there being but little of this class available. The present stock is largely of an inferior character, which causes low quotations to appear, and has a very depressing effect on the market.

CEDAR.—Stocks of all kinds are very light. Prices remain firm, especially for wood of good character.

KAURI PINE has been freely enquired for. Present ruling prices are somewhat higher than buyers have been in the habit of paying of late. This tends rather to restrict business.

SEQUOIA.—Considering the low figure which is ruling for this

wood, it seems a little surprising, having in view the splendid dimensions to be obtained, that it does not find a larger consumption. Although enquiries are not brisk, the wood is gradually forcing its way into notice.

AMERICAN WALNUT.—Several very inferior parcels of logs have been sold at public auction, without reserve, and realised prices which must show a considerable loss to the shippers, the demand for this description of wood being almost nil, whilst prime sizes and quality consignments would readily sell at full values. The market is entirely bare of first quality wood.

There is also a good market for the better qualities of planks and boards, but culls and inferior grades, of which heavy shipments have been lately made, are very difficult to move.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(From our own Correspondent.)

THE state of the shipbuilding and engineering trades in Scotland at the present time is certainly a distinct grade better than it has been at any other period during the past nine months, and a tone of greater confidence is therefore evinced in the markets which supply these trades with material to work upon. During the month a good deal of general iron and steel work has been placed with leading local firms, and there are some very good contracts, especially for bridge work, which are expected to be settled immediately. As may naturally be expected from the list of contracts for tonnage placed, which follows, a large quantity of all classes of shipbuilding material has been booked, several firms being better secured in this respect than they have been at any time during the previous portion of this year. There is no doubt that the increased briskness in the steel and iron trades here is very largely due to the coal strike in the Midlands which, causing as it does the shutting down of several works there, has sent the orders up to the North. It may be that this improvement is merely a flash in the pan, but we sincerely hope, and in fact predict, that the bottom has been reached and that the worst is now over. At the beginning of this month Messrs. A. & G. Inglis, Pointhouse, secured the contract for two first-class steamers of slightly over 2,000 tons each for the British India Steam Navigation Co., and the abnormal dulness in this yard thereby tided over. On the very next day, viz., the 5th, it was announced that Messrs. Wm. Hamilton & Co., Port-Glasgow, had contracted to build a steel sailing ship of about 3,600 tons carrying capacity for Messrs. James Cornfoot & Co., Glasgow. Messrs. Russell & Co., shipbuilders, of the same port, about the same time closed a contract with Messrs. Lewis T. Merrow & Sons, of Glasgow, for a first-class steel sailing ship, of 2,700 tons deadweight, whilst Messrs. Charles Connell & Co., of the Scotstoun yard, booked an order to build a cargo steamer of 4,500 tons deadweight for Messrs. James Little & Co., Glasgow. Port-Glasgow however, not content with the foregoing orders, came to the fore in the middle of the month and scored again by Messrs. Russell & Co. securing an order for three sailing ships of 2,800 tons deadweight capacity each, for Messrs. Andrew Weir & Co., shipowners, Glasgow. The same owners in addition placing the order for a fourth vessel to carry 3,200 tons deadweight, with Messrs. Mackie & Thomson, Govan. The Campbelltown Shipbuilding Co. were again saved from despondency by securing the order for a coasting steamer to attain a speed of 12 knots. Machinery is to be supplied by Messrs. Rankin & Blackmore, of Greenock.

The orders booked are brought to a conclusion on the west at least, by Messrs. R. Napier & Sons, Govan, securing orders for two South American steamers, a mission boat, and two large screw steamers for passenger trade, and we think the list speaks for itself in support of the first statement in our Notes, that trade is certainly improving. It is true that no "long" prices are being obtained, but we have it on substantial authority, that they are at least remunerative to some extent, which we regret to say could barely be said of one or two orders placed earlier in the year.

The East Coast is unable to say much for itself as yet, but amongst the numerous enquiries which are circulating it is more than probable that a fair amount of tonnage may be booked in the near future. Messrs. The Grangemouth Dockyard Co. have received an order from Messrs. Rabicen & Stadtlander, of Bremerhaven, to build a steel screw steamer of 1,700 tons for their Baltic trade, the machinery being supplied by Messrs. Hutson & Son, Kelvinhaugh Engine Works, Glasgow. It is expected that a Dundee firm of shipbuilders will book a very good order before this goes to print, but we must not be too premature.

The work of constructing a new graving dock at Leith is now progressing rapidly, whilst Messrs. Kinnear, Moodie & Co., the contractors, are about to make a show with the new wet dock, through the reclaiming of the foreshore to the east of the present Edinburgh Dock is a work of time.

Messrs. Charles Brand & Co., Glasgow, are now engaged on active operations at Port Ness, Isle of Lewes, constructing a breakwater to the designs of Messrs. Stevenson, civil engineers, Edinburgh. The work, which is partly at the recommendation of the Highlands and Islands Commission, is estimated to cost about £15,000.

On the 4th ult. there was delivered to Messrs. Crow, Harvey & Co., Park Grove Iron Works, Glasgow, the first of two cheeks for a plate shearing-machine, which is believed to be the largest casting of the kind made in Scotland, it weighing about 30 tons. While treating of the matter of weights it may interest some of our readers to know that the large crane at Greenock, which recently had its lifting powers increased from 70 to 100 tons, tackled its first heavy lift since its test, the weight of the main boilers for the P. & O. steamers being slightly over 70 tons, and these were lifted on board at the beginning of this month.

The *Borsen Halle*, of Hamburg, contained lately the following reference to Mr. Edmund Sharer, the new manager of the Fairfield Shipbuilding Co.:—"From Newcastle-on-Tyne it is reported that Mr. Sharer, who has been for some six years manager of Edwards' Shipbuilding Co., Howdon-on-Tyne, has just been appointed successor to Mr. Richard Saxton White as general manager of the Fairfield Shipbuilding Co., on the Clyde. Mr. Sharer, who is still comparatively young, being about 36, has already won a name for himself for breadth of view and smartness in shipbuilding, and has often been consulted as an authority on difficult questions of naval architecture. He has also been a surveyor to Lloyd's. Mr. Sharer is well known in Hamburg, having superintended the construction of a number of large vessels built to Hamburg orders."

A very considerable amount of tonnage is now on hand in several of the yards, Messrs. Stephen, of Linthouse, and Messrs. Barclay, Curle & Co., Whiteinch, being amongst the busiest. Messrs. Inglis, of Pointhouse, are also busy, and in the course of a month or so will be busier still when the two British India boats begin to appear on the stocks.

On the 31st July the new Cunarder, *Lucania*, left Marisbank for the Tail of the Bank. A large crowd saw her off, and both banks of the river, as far as Scotstoun, were lined with spectators. There was a fairly good tide, and though the big ship drew 26 ft. of water, she was navigated safely down the Channel. It has since been ascertained that she touched the bottom at one place and slight damage was done, but this has been greatly exaggerated. As a matter of fact only a few plates were bulged, and these are being removed in the dry dock at Birkenhead and replaced by new ones, though, of course, the cutting of inch steel rivets is a very laborious job, and it will therefore occupy the intervening time between now and the 2nd September, her advertised date for starting on her maiden Transatlantic trip. She has already on her trip, without being pushed, developed 23¼ miles per hour, and it is expected that she will make even a better record on her outward trip than her sister ship the *Campania* did. The *Lucania's* tonnage, it will be remembered, is 12,950 tons, while her engines develop over 30,000 H.P.

The threatened strike of furnacemen employed by Messrs. John Wilson & Sons, at the tube works in Helen Street, Govan, has been delayed for a time. The men were reduced 5 per cent. in their wages in October last, a promise being made at the same time that when trade improved and the works were busy the reduction would be taken off and full pay given. At the same time the working hours were reduced from 57 to 54, and part of the agreement was that no alteration be made in the number of hours. Since the Fair holidays the men have thought that the condition of trade justified the redemption of the promise, and negotiations were commenced with the manager. Last week a notice was posted on the gate conceding 5 per cent. of an increase on condition that the men should work 57 hours per week. The men held a meeting afterwards, and a deputation waited on the manager, with the result that the notice was withdrawn, and the men have got one week to come to a decision. During that time matters will remain as at present.

Since the foregoing list of contracts booked was made out the

following additional orders have been secured:—Messrs. Caird & Co., Limited, shipbuilders, Greenock, have received a contract from the Stoomvaart Maatschappy Nederland, of Amsterdam, to build for them a steel screw steamer of about 3,800 tons for their first-class Royal Mail Service to Java. Messrs. Russell & Co. have also received two important contracts to execute in their Kingston Shipbuilding Yard, Port-Glasgow, and it is rumoured that Messrs Blackwood & Gordon have also secured a good order for steamers.

We regret to announce the death on the 31st July of Wm. Skirving Cumming, of Messrs. Cumming & Ellis, shipbuilders, Inverkeithing. Mr. Cumming, who was a very promising young shipbuilder, was the second son of Mr. David Cumming, Blackhill Dock.

TRADE NOTES FROM THE TYNE, WEAR, TEES, HARTLEPOOLS, &c.

(*From our own Correspondent.*)

THE TYNE.

Shipbuilding.—That there has been a very considerable increase in the number of shipbuilding orders placed during the past two months, as compared with the transactions of this kind carried out in the earlier part of the year, there is no reason whatever to doubt; but it is equally true that the spurt which occurred a few weeks ago is now over, and we have again arrived at a period of few enquiries, and fewer transactions completed. This is not to be wondered at, seeing that the sudden improvement was brought about by the extreme lowness of prices, and as these have begun to stiffen, the demand—which was not of the genuine kind, caused by a real deficiency in the supply of tonnage—was very speedily checked. It lasted long enough, however, to place many of the leading Tyneside firms in a position of security against slackness for ten or twelve months to come, and it is in every way probable that a real revival in shipbuilding will have made its appearance by that time. The firms which appear to have been most successful in booking orders are Messrs. Wigam Richardson & Co. and Messrs. C. S. Swan & Hunter. The first-named firm have added to the list of contracts on their books, one for a fast passenger and fruit boat to be built on Mexican account and have also, it is said, received an order to build three more steamers for the "Adria" Co. of Fiume and Budapest, to whose order they have already built and engined over a dozen vessels of a very superior type. Their frame furnaces are now in operation night and day, and in the outdoor departments, the greatest activity prevails. At Messrs. Swan & Hunter's yard, further extensive changes are being carried out with a view to minimise to the greatest possible extent the expenditure of time and labour, in completing contracts, and it would seem as if they were determined to leave nothing undone to secure the best results in the direction of economical production. The firm have booked some important orders during the month, among the number being one from Messrs. Harrison, of Liverpool, for a vessel of 6,000 tons capacity. The Palmer's Co., of Jarrow, are understood to have secured a good many orders—principally from Liverpool owners—and it is believed that their establishments at Howdon and Jarrow will be kept going at a steady rate during the remainder of the year. The Tyne Shipbuilding Co. are extremely busy, and at Messrs. Dobson & Co.'s yard, the outlook has improved. Messrs. Armstrong, Mitchell & Co., though still having the stocks at their Walker yard, well occupied, are understood to be short of orders. This, however, is mere outside opinion, founded probably on the circumstance that there is momentarily an absence of pressure in the departments dealing with the earlier stages of work. It is needless to say that a temporary slackness in these departments may arise from other causes besides lack of orders, and so far as this firm is concerned, it is as well not to assume that orders are scarce, until something more definite in the way of proof is forthcoming. The Edwards' Shipbuilding Co. have booked two orders from local firms for vessels of large tonnage, and these, with the order mentioned in last month's Notes, may be expected to keep the yard in full employment over the winter months. The large pontoon, built by the firm for the Manchester Ship Canal Pontoon and Dry Docks Co., Limited, was successfully launched on the 12th ult., and left the Tyne three days later in tow of two powerful tug boats, for its destination at Ellesmere Point, on the lower reaches of the Canal. Messrs. Edwards & Sons have recently acquired the shipbuilding and engineering premises, with all the machinery and plant, formerly held by Messrs. Hepple, at North Shields, and have also acquired additional engineering premises at South Shields. They have thus added considerably to their extensive works, which now consist of five large graving docks, a shipbuilding yard, and two engineering establishments. Messrs. Hepple have taken premises at South Shields, in which they intend to continue the business of ship and engine repairing. It has not transpired that Messrs. Hawthorn & Leslie have booked any orders lately; but they have enough work in hand to keep the yard busy for some months yet. The whole of the berths at Messrs. Schlesinger & Davis's spacious yard are still unoccupied; but there is reason to believe that when trade improves this establishment will again have a share of such work as may be available. Rapid progress is being made with the work of constructing a large graving dock in connection with the works of the Wallsend Slipway Co., and it will probably be ready for use early next year.

Engineering.—The engineering industry shows more improvement than the shipbuilding trade, as there are a number of "conversion" orders to be dealt with, in addition to the orders for new machinery. At the Neptune Engine Works there is an abundance of new work, and the engines of a foreign steamer are to be "converted" from compound to triple-expansion. Business at the Wallsend Slipway Engineering Works is also very active, some good orders having been recently secured, and the neighbouring establishment of the North-Eastern Engineering Co. continues to be well employed. Full activity is maintained at Messrs. Readhead's works, Tyne Dock, and the same may be said of the St. Peter's Engine Works, where a large vessel, built at Hebburn for employment in the dead meat trade, is now receiving her machinery. Great dulness continues to exist at the engineering establishments comprised within the Newcastle area, including the famous Elswick Works; but at Gateshead, several establishments are busy, including Emerson, Walker & Thompson Bros., Limited; Clark, Chapman & Co.; and Carrick & Wardales. The Winlaten Nut and Bolt Co. are carrying out extensions of premises, and have invited tenders for the supply of a 25 H.P. gas engine. Messrs. G. R. Toomer & Co., engine and ship repairers, Tyne Dock, have erected new premises, to which they will remove very shortly. The site selected is a most suitable one, being adjacent to the dock entrance, and in close contiguity to Messrs. Readhead's Shipbuilding and Engineering Works. The premises will comprise a fitting shop, a joiner's and patternmaker's shop, and a smith's shop, all of which will be equipped with the best modern machinery. A new shipbuilding, boiler and engine building, and repairing establishment, is about to be started at South Shields by a newly formed company, for whom Mr. R. D. Lawson, late manager at Messrs. Hepple's Works, North Shields, is managing director. An extensive fitting shop has already been erected, and other preparations for commencing business are in active progress. This enterprise is being started under most favourable auspices, and with the experienced guidance of the gentleman named, can hardly fail to be successful. The site has a river frontage of over 50 ft., and there is abundant room for the carrying on of the various branches mentioned.

Messrs. J. H. Bentham & Co., manufacturers of India rubber goods for engineering and other purposes, have just opened newly-erected premises in the Side, Newcastle, in which an active business is now being carried on. The premises, which are known by the name of the "Bentham Buildings," comprise warehouses, show-rooms, and offices, and besides being from the architectural point of view an admirable addition to the locality, are replete with every accessory for the prompt despatch of business. Messrs. Proctor & Son, whose offices and show-rooms are also in the Side, are able to keep their manufacturing department at Wallsend in active operation, orders for ventilators and other steamship accessories being now very plentiful. The firm recently completed an important order for ventilators, &c., on H.M.S. *Resolution*, and have now in hand a good deal of similar work for the sister ship *Revenge*, which is still lying at the yard of the builders, Jarrow. Mr. W. F. Snowdon has the contract for covering with his well-known, non-conducting composition, the boilers and steam pipes of the s.s. *Berthshire*, now being engined at the St. Peter's works, and has several similar contracts to execute within the next few weeks. Mr. Beynon, the newly appointed agent in this district, for the sale of Walter's marine glue, has been very successful with that speciality, having among other orders received one for no less a quantity than two tons of the commodity, from a local shipbuilding firm. The demand for the boiler preservative known as Zynkara, has been very active lately, but the

increased facilities for manufacture, which have been provided by the patentees has enabled them to meet the requirements of customers. Messrs. George Noble & Co., consulting engineers, of 40, Westgate Road, Newcastle, have been appointed the sole representatives in the North-eastern district for Messrs. Stone & Co., brass founders, &c., Deptford, London, S.E.

Electric Lighting.—Messrs. J. H. Holmes & Co., continue to be very busy with ship installations, having vessels in hand at most of the shipbuilding centres in the country. The firm have just contracted to put an installation of 400 lights in a new building erected by the Prudential Assurance Society in Newcastle, and have also contracted for the lighting of the Wallsend and Hebburn Collieries. Messrs. Rowland, Barnett & Co., have obtained the contract to put an electric lighting installation in the Tyne Steam Navigation Co.'s steamer *Juno*. Messrs. E. Scott & Mountain, Limited, have recently secured several contracts of importance in both the electrical and engineering departments.

THE WEAR.

Shipbuilding.—During the recent brief period of activity in estimating and negotiating, a few orders have come into the hands of Wear shipbuilders, and at one or two establishments there is now an appearance of increasing work. At Mr. Laing's yard, there are six berths occupied, two of the vessels on the stocks being yet in early stages of construction. In the graving dock, the large mail steamer *Trinidad* is being lengthened. Owing to the great extent of the alterations, &c., to be carried out on this vessel, two or three months are likely, to elapse before she is again undocked. It is reported that Messrs. R. Thompson & Sons have some work to go on with, and in confirmation of this, it may be stated that they are now laying the keel for a vessel. For some time past the Bridge graving dock, belonging to the firm, has been kept regularly occupied. Messrs. Osborne & Graham, after a long spell of inactivity, are again becoming busy, and a number of the operatives have been taken on. Messrs. Priestman have but a limited amount of work in progress, and at Messrs. Pickersgills' the state of matters is still worse, as there is practically nothing to go on with. The framing of an exceptionally large cargo-boat is being proceeded with at Messrs. Doxfords, and there is other work of a special kind in hand. At Messrs. Short Brothers, the quantity of work in hand is quite up to the average. Messrs. J. L. Thompson & Sons' yard is still busy, and it may be stated with truth that this establishment has never been really slack, during the past half-dozen years, though within the last year or two many noted yards in different parts of the country have felt the touch of adversity. The firm have recently launched a couple of vessels, and keels for others have since been placed in the vacated berths. At present there is but a small amount of repair work in hand, but an increase of activity in this department is expected. Messrs. Blumer & Co. have a vessel to launch shortly; but their establishment is on the whole rather slack, and there does not at present appear to be much prospect of any substantial addition being made to the work in hand. Messrs. Bartram & Haswell have commenced the construction of a large vessel, and the Sunderland Shipbuilding Co. have also one in an early stage of building, which description may further apply to Messrs. Austin and the Strand Shipbuilding Co., only in the last two cases, the vessels building are of smaller dimensions than in the former establishments. Messrs. M. Robson & Sons have recently completed, at their boat-building works, Monkwearmouth, an unsinkable lifeboat, the invention of Mr. C. Gardner, of Redcar, who has made this subject a special study. The boat, which is 22 ft. long, is decked throughout, and cannot ship any water when in use. As she is to be propelled by oars however, like any other lifeboat, apertures have been made in the deck for the special use of the rowers, who will do their work standing. As a provision against the admission of water, oilskin connections of the requisite cylindrical shape are attached to the apertures, the tops being drawn tightly round the men's waists, when the latter are in position rowing. The boat is so constructed as to right herself immediately in the event of being suddenly turned over by the force of a heavy sea, which is a contingency little short of impossible. In any case the occupants of the boat would be quite safe, as the boat could only be momentarily submerged, and due provision is made for the admission of a sufficiency of air. The boat, it is stated, is capable of carrying from 40 to 50 persons, besides 160 gallons of water and five hundred weight of provisions. It should be stated that there is a small hatchway on the deck to give access to the interior, and this is, of course, closed, when necessary. Messrs. Robson have a smaller boat of the same type, almost completed in their works, and it is, if anything, a neater looking craft than that just described. Both these unique specimens of the boat builders' art are well calculated to sustain the reputation of Messrs. Robson's establishment.

Engineering.—The marine engineering establishments are distinctly busier than last month and at one or two factories hands have been taken on. At the Palmer's Hill Works, night work is being resorted to, and considerable animation exists throughout the various departments. The large steamer *Queen Louise*, which was recently launched from the yard of Messrs. Bartram & Haswell, is now at the quay receiving her machinery. at Messrs. W. Doxford & Sons, the state of business is satisfactory, and at Messrs. Clark & Co.'s establishment, additional orders have been booked. Considerable briskness exists at the works of Mr. John Wigham, Hylton, where some new specialities in the way of steamship accessories, are being manufactured. Business at most of the iron foundries, is still very good, and forging establishments continue to be kept steadily going. Brass founders and coppersmiths are tolerably busy, and chain and anchor manufacturers are having more orders than for some time past.

The Hartlepools.—The shipyards belonging to Messrs. W. Gray & Co., maintain an appearance of full work, and the graving docks owned by the same firm are kept pretty constantly occupied with vessels undergoing painting or repair. The other shipbuilding firms at this centre have a good supply of new work, which is supplemented to an important extent, by occasional repair contracts. The engine and boiler works of Messrs. Thomas Richardson & Sons continue to be well employed, and at the Central Marine Works, quite exceptional activity exists. At the time of writing, a large steamer, built by Messrs. C. S. Swan & Hunter, Wallsend, for Messrs. The Shaw, Saville and Albion Co., Limited, is receiving her machinery at the sheerlegs. At the local steel works, business is fairly brisk, and the Hartlepool rope works are kept in steady operation. Arrangements for starting a new branch of industry in connection with this establishment are in an advanced stage of progress.

Stockton.—At this centre shipbuilding continues fairly active, the whole of the yards having vessels on the stocks. Messrs. Blair & Co.'s works are still kept going steadily, and are likely to continue so for months to come. During July the following vessels, engined at the works, have had their trial trips:—The s.s. *Athens*, built by Messrs. Richardson & Duck, of Stockton-on-Tees, and sold to Messrs. A. C. de Frietas & Co., of Hamburg, having engines 21 in., 35 in., 57 in. by 39 in. stroke.; the s.s. *Beltor*, built by Messrs. Ropner & Son, of Stockton-on-Tees, for Messrs. Holman & Son, of London, having engines with cylinders 22½ in., 37 in., 61 in. by 42 in. stroke; the *Gena*, built and owned by Messrs. Thos. Turnbull & Son, of Whitby, having engines with cylinders 23 in., 37½ in., 61½ in. by 39 in. stroke; the s.s. *Demetro S. Schilizzi*, built by Messrs. William Gray & Co., of West Hartlepool, for Messrs. Foscolo Mango & Co., of Constantinople, having engines with cylinders 22 in., 36 in., 59 in. by 39 in. stroke; the firm have just completed the conversion of the compound engines of the s.s. *Mathew Bedlington*, to triple-expansion engines, and this vessel also had her trial trip in July, the result being eminently satisfactory to all concerned. The engines for all the steamers mentioned are constructed to work at 160 lbs. pressure of steam, and on the trial trips their working gave complete satisfaction. The smaller engineering and boilermaking establishments at this centre are generally kept busy.

Middlesbro'.—The state of work at Sir Raylton Dixon & Co.'s shipbuilding yard shows an improving rather than a retrogressive tendency, and there is every prospect of a busy time in the establishment throughout the winter. In connection with the other yards there is practically no change to note. Steel works are kept busy and foundries show an improvement upon the state of affairs that existed some weeks ago.

Consett.—Orders for steel plates for shipbuilding and boiler-building purposes continue to be very plentiful at the Consett Iron and Steel Co.'s works, and the mills continue in full and active operations.

NORTH-WEST OF ENGLAND.

(From our own Correspondent.)

Barrow-in-Furness.—There is practically nothing doing in the shipbuilding trade in this district. The work in hand is gradually being cleared out, and the several departments are employing, week by week, fewer workmen. The last ship is on the stocks, the second of the two being built for the British and African Co., but another order for a cargo boat has been secured from Mr. Royden, of Liverpool, during the month, and hopes are entertained that further new orders will be secured in the course of a week or two. But the demand for new tonnage is exceedingly small, and Barrow is suffering along with other shipbuilding centres from a depression which is the result of the very small shipping trade which is being done throughout the world, the large amount of shipping which is laying up idle, and absence of profits on the tonnage which is being worked. The engineering department of the Barrow yard is also in a very quiet state, and the need of new orders is most marked. Some repair work is in hand, but this does not employ very many men. The steel shipbuilding material trade is very quiet, and the mills at Barrow are still idle, as the prices at which makers in other districts are selling their plates, &c., precludes the possibility of any profit being made in this district. Steel castings of heavy weights are in steady demand for shipbuilding purposes.

THE MERSEY.

(From our own Correspondent.)

NOTHING at all satisfactory can be reported as regards the outlook of trade in this district, and the general stoppage of the collieries during the past month has by no means tended to improve the position. The difficulties of obtaining fuel supplies have necessarily considerably interfered with operations at many of the works, and although establishments on the Mersey have been able to obtain supplies pretty readily from other districts, where the pits are working, at no very largely increased cost, inland requirements have not been so readily covered, and in many cases works have either had to partially suspend operations or to stop altogether. With regard to the shipbuilding industry, although there are some enquiries stirring, it is only in isolated cases where any disposition is shown to look to the future more hopefully. As a rule, the tendency is, if anything, towards increasing depression, and this is felt especially by the largest firms. Marine engineers report a continued complete absence of any new work coming forward, whilst boiler makers are only getting occasional orders for repairs or refitting steamers with new boilers capable of standing the increasing pressures that are now required. The general engineering trade remains in much the same position as reported last month. A few of the machine tool makers are fairly busy, but for the most part they are very short of orders, and new work is only coming forward in limited quantities, which offer no very encouraging prospect for the future. Most of the boiler makers are fairly busy on inland work, and stationary engine builders are generally also kept pretty full of orders, but in the general run of engineering there is very little doing. The returns of the Trade Union organizations as to the state of employment fully bear out the unsatisfactory position of the different branches of the engineering industry already referred to. The Amalgamated Society of Engineers has a larger number of unemployed members on its books than for a considerable time past, there being an increase of quite 1 per cent. on the returns of the previous month, the number of out of work members in receipt of support now being about 8 per cent. of the total membership. The Steam Engine Makers' Society has also shown a slight increase during the past month, but not to very appreciably affect the general returns, which still barely show 4½ per cent. of the total membership in actual receipt of out of work support. To some extent, the stoppage in the coal trade is accountable for the increasing number of unemployed, owing to suspension of operations at a good many of the works, but the unsatisfactory condition of trade generally has also contributed very materially in throwing a larger number of members on the books, and the Steam Engine Makers' Society state that the exceptionally depressed condition of the shipbuilding trades accounts for a large proportion of the out of work members on their books.

Messrs. Fawcett, Preston & Co., Limited, of Liverpool, have during the past month, completed the refitting of Mr. James Gordon Bennett's yacht, the *Namouna*, to which we made reference in our previous issue; and the preliminary trials have been most successful, showing a performance considerably in excess of the contract speed. Messrs. Fawcett, Preston have supplied us with the following details of the engines and general equipment of the vessel, put in by them, which will be of interest to our readers. The engines are of the triple-expansion type, with three cranks. The stokehole is closed and supplied with forced draught. The diameter of the high-pressure cylinder is 21 in., the diameter of the intermediate pressure cylinder is 34 in., and the diameter of the low-pressure cylinder, 55 in., with a stroke of 30 in. The crank shaft is 10 in. diameter; the air-pump is 18 in. diameter, with 18 in. stroke; the bilge pumps (two in number), are 4 in. diameter, with 18 in. stroke. The surface condenser is fitted with 934 brass tubes, three-quarters in. diameter, having a total cooling surface of 2,353 square ft. The slide-valves are placed on the front of the cylinders, and are actuated by single eccentric radial gear. Aspinall's governor is fitted to prevent excessive racing. A Weir's feed-pump is put in for supplying water to the boilers, and has a steam cylinder 9 in. diameter, pump 7 in. diameter, with a stroke of 21 in. A Worthington Admiralty pattern vertical pump is used as an auxiliary feed to the boilers, and for general ship purposes, and has steam cylinders 6 in. diameter, 6 in. stroke, and pumps, 4 in. diameter and 6 in. stroke. A centrifugal pump made by Messrs. Gwynne is provided for circulating cooling water through condenser, and the diameter of the suction and delivery pipes is 11 in. The blowing engine for the forced draught has a fan 5 ft. 6 in. diameter, 1 ft. 10 in. wide, driven by Chandler's patent engine. A Quiggin's evaporator is put in, capable of supplying ten tons of fresh water per 24 hours, together with a Quiggin's feed water heater and Harris's feed water filter. The propeller has a diameter of 10 ft. 5 in., pitch 15 ft. with a surface of 37 square ft., and it is of a special design. Two boilers are 13 ft. mean diameter 10 ft. 3 in. long, made entirely of steel, and are constructed to meet the requirements of the American Board of Supervising Inspectors and Lloyd's Register of British and Foreign Shipping for a working pressure of 175 lbs. per square in. All the plates and the corrugated furnaces, it may be added, were manufactured in America. The sheet plates are 1 5-32 in. thick. There are three corrugated furnaces in each boiler, 3 ft. 3 in. mean diameter, with 310 tubes 2¼ in. external diameter in each boiler. The total heating surface in the two boilers is 3,508 square ft. The total grate surface is 117 square ft. During the sea trials and going with the tide the *Namouna* made 16½ knots per hour, whilst returning against the tide the speed was 13¾ knots per hour, making an average speed of 15⅛ knots per hour, which as the condition imposed by the owners was that the speed should not be less than 14 knots per hour, shows an excess of 1⅛ knots over the contract speed. In addition to the official trials, the *Namouna* had subsequently an opportunity of testing her speed against the *St. Tudno*, one of the quickest passenger steamers sailing out of the Mersey, and over the measured mile these two vessels kept level the whole of the distance, a very gratifying result to the captain, engineers, and all concerned.

Visiting the shipbuilding yards on the Liverpool side of the Mersey, there were ample evidences of the exceptional depression prevailing throughout this branch of industry. Messrs. Royden Bros. have practically nothing whatever in hand, and their yard has been bare of orders for several months past. Messrs. Potter & Sons have in hand a small steel steamer for the Brazils, for combined passenger and cargo service, which is to be fitted with engines supplied by Messrs. Dunlop, and with twin screws, whilst they have been kept fairly occupied in repairs, and they seem to be better off than any other builders on this side the Mersey.

Messrs. Laird Bros., of Birkenhead, as reported last month, are gradually completing all the more important work which has been keeping them busy for some time past, and report no new enquiries of any moment just at present coming forward. The first-class line of battleship, the *Royal Oak*, will probably be out of their hands in the course of about another month, and during the past month the large pleasure yacht, the *Valiant*, built by them for Mr. W. K. Vanderbilt, which has been practically completed for some time past, has undergone a series of most satisfactory trials, and is now delivered into the hands of the owner. The general description of this vessel, which is the largest and most perfectly fitted-up yacht in the world, will be found in another column, and we need only here deal briefly

with some of the main features of her engines and the work accomplished during the trials. The engines are twin triple compound, similar to those in the *Ibex* and the *Duke of Clarence*, by the same builders; cylinders, 23 in. by 36 in. by 55 in., and 3 ft. stroke; boilers, two double-end and a single-end, 15 furnaces in all, 160 lbs. pressure, steel shafting throughout, brass condensers, bronze propellers, and the general finish of machinery and furnishing of engine-room exceptionally well got up. The electric installation is in duplicate, each equal to 310 lights. The refrigerating room is of large capacity, and the ice-making machinery equal to 280 lbs. per day The compressed air machine for ventilating purposes, steam steering gear, steam windlass and warping capstan, have all been thoroughly tested during the various trials. A series of trials under varied conditions has been made in the Liverpool Bay, under natural draught, when a speed of upwards of 15½ knots was established, which may be assumed to be the ordinary seagoing speed. Under forced draught and full power, she ran for upwards of six hours, the mean revolutions being 145 per minute; not a warm bearing, hitch, or stoppage of any kind. A run to the Clyde was made under natural draught, and the distance between the Liverpool Bar and the Cumbraes (170 knots) was covered in 10 hours 50 minutes, giving an average of 15·7 knots. On the Skelmorlie measured mile, under forced draught, the mean of two runs gave upwards of 17 knots, whilst the mean of the whole series was a fraction below. The weather was squally, with a strong breeze, but the result was very satisfactory, as she had 700 tons of coal and stores on board, sufficient for a run across from New York to the Mediterranean ports at 15 knots speed, without intermediate call. There was, under all conditions of speed, an almost entire absence of vibration, a feature which her builders have so successfully achieved in the many powerful and fast twin-screw steamers they have built. We may add that although the *Valiant* is capable of carrying coal supplies and stores to take her across the Atlantic, or any similar long voyage, without the necessity of calling at port, it would, of course, be unnecessary, under ordinary pleasure trips, to load her with such a large weight of coal, and with the ordinary yacht quantity of coal on board, the builders are satisfied she will be able to maintain an average speed of 17½ knots per hour.

The stoppage of the collieries has quite unsettled the iron market during the past month. Most of the local and district pig and finished iron makers have withdrawn quotations owing to the damping down of furnaces or the stoppage of works, and business has been restricted to the smallest possible quantities for covering actual pressing requirements. Lancashire makers of pig iron, who have been getting about 43s. 6d. for forge, up to 45s. and 45s. 6d. for foundry, less 2½, delivered in this district, have, at the close of the month, withdrawn their list rates, and are only open to entertain offers subject to special quotations from the works. With regard to district brands there are only one or two makers now offering in the market, but Lincolnshire could still be bought at about 40s. for forge to 41s. 6d. and 42s. for foundry, net cash, and Derbyshire, 47s. 6d. to 48s. for foundry, net cash, delivered in this district, at which figures there has been a fair amount of business put through. Outside brands offering here have been rather irregular, but are showing a decided upward tendency, good foundry Middlesbrough having hardened up to 44s. 4d. and 44s. 10d., net cash, delivered Manchester, whilst it has been difficult to get quotations at all for Scotch iron; but where there have been sellers they have not been disposed to take anything under 45s. 6d. for Eglinton to 47s. 6d. for Glengarnock, net, prompt cash, delivered at the Lancashire ports.

With regard to finished iron, the one or two makers who have been prepared to sell have necessarily been holding out for advanced prices; for inland business, however, it has been difficult to get more than £5 12s. 6d. for bars, delivered, but for shipment sales have been made at £5 15s., delivered at the ports on the Mersey. For sheets there are no fixed quotations, and small quantities can only be bought from local makers at special prices. Hoops have remained unchanged, being still quoted at £5 17s. 6d. for random, and £6 2s. 6d. for special cut lengths, delivered in this district, and a fair business has been done where makers have been able to sell.

In the steel trade hematites have remained unchanged at about 54s., less 2½, for good foundry qualities, delivered, but for steel billets, which have been selling at £4 8s. 6d. to £4 10s., net cash, delivered, makers have withdrawn quotations. For manufactured steel a fair demand is reported, chiefly on account of construction work, and steel angles have been selling at £5 5s. to £5 7s. 6d., steel bridge plates at £5 15s., and the best steel boiler plates are firm at £6 10s. So far as plates for shipbuilding purposes are concerned there has been, however, an almost complete absence of inquiry, some of the principal sellers reporting that they have booked no orders of any moment for a considerable time past, and quotations, so far as any actual business is concerned, are therefore simply nominal.

In the metal market a moderate amount of business has been coming forward, but the only change to notice, is rather a tendency to harden, in brass tubes. The list prices for delivery in this district are as under:—solid drawn brass boiler tubes, 5½d.; solid drawn brass surface condenser tubes, 6½d.; solid drawn copper tubes, 7½d.; brazed copper gas and steam tube, 7d.; brazed brass gas tube, 6d.; brazed brass machine tube, 6½d.; brass wire, 5½d.; copper wire. 6½d.; rolled brass, 5½d.; sheet brass, 6½d.; yellow metal condenser plates, 5¾d.; cast composition sheathing nails and spikes, 5½d.; cast red metal sheathing nails and spikes, 7½d.; wrought copper rivets, 8½d.; wrought copper boat nails, 8½d. to 9½d.; wrought copper tacks, 11½d. to 1s. 2½d. per lb.; copper bolts, £61 per ton.

Business in the timber trade has, on the whole, been quiet, and imports generally have been ample for the dragging demand. Values although steady show little or no improvement, and stocks of all articles are fairly large. The imports of East India teak have been light but sales have been difficult, and the market is weak. Of greenheart there has been a further arrival, but with quite a nominal consumption it has all gone into the yard to increase the already heavy stock.

In the coal trade, business generally has been only quiet, since the stoppage of the pits, and with the close of the month the inland demand has fallen off very considerably, consumers who for the most part, are fairly well supplied, working off their stocks before buying further, in the expectation of some possible early change in the present position. There has been a very general upward movement in prices of from 5s. to 6s. per ton, and at the pit mouth the best screened coals are now quoted at 15s. to 16s. For steam, forge, and manufacturing requirements, consumers have had to go largely upon through and through coal which now ranges, according to quality, from 12s. 6d. up to 14s., whilst engine fuel, of which there is only a small quantity held, is fetching from 10s. for the commonest sorts up to 11s. 6d. and 12s. for the better qualities at the pit mouth. The shipping trade has been altogether disorganised as a result of the stoppage of the pits, and South Wales and Scotch coal has been largely coming into this district at sufficiently low prices to readily take the place of Lancashire coal. The temporary stoppage of the pits in South Wales for the time being brought an increased demand on to Lancashire coal, and sellers were able to get quite 16s. per ton, delivered at the ports on the Mersey, with a tendency to harden 6d. to 1s. on this figure, and Scotch coal has also, with the close of the month, shown a tendency to harden up about 2s. per ton, but it is difficult to give anything like definite prices as they are so largely governed by circumstances arising from day to day.

Holzapfel's Composition Co., Limited. — Following up the main points in the remarks made by Mr. Martell, in the discussion on the paper on the "Wear and Tear in Ballast Tanks," read by Mr. Andrew K. Hamilton, at the recent meeting of the Institution of Naval Architects at Cardiff, the above named company have issued a circular dealing fully with the quality, price, and requirements of paint which will best achieve the result pointed out by Mr. Martell and other gentlemen. They strongly recommend the use of Danby's Patent Anticorrosive composition, which has been under trial by Captain Danby, the inventor, for many years, and the manufacture of which they are carrying on under a letter of license from that gentleman. The company state that a number of their friends are inserting a printed specification, which they have issued by special request, for gumming into the specifications for new vessels, and they are prepared to supply these specifications to all who may want to use them. The circular contains extracts from the remarks of Mr. Martell and other gentlemen in the before mentioned discussion.

Steam Tender.—Messrs. Harland & Wolff, Belfast, have received an order to build a large steam tender for Messrs. Ismay, Imrie & Co., Liverpool.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Rhone.—On July 18th Messrs. Cochrane & Cooper launched from their yard at Beverley, the steam trawler *Rhone*, built for Mr. G. F. Sleight, Grimsby. The vessel is 80 ft. long, 20 ft. beam, and 10 ft. 8 in. deep.

Massapeque.—On July 27th there was launched by Messrs. Joseph L. Thompson & Sons, at Sunderland, a screw steamer, built to the order of Messrs. Hogan & Sons, of New York. This vessel is of the spar-deck type, and has been constructed under special survey for Lloyd's classification. The engines, which are of the triple-expansion type, are being supplied by Messrs. George Clark, Limited. These engines are about 1,500 I.H.P., having cylinders 24½ in., 40 in., and 66 in., with a stroke of 45 in. The vessel was named the *Massapeque*.

Italian Prince.—On July 28th Messrs. Short Brothers launched at Pallion, Sunderland, a screw steamer, built to the order of Mr. James Knott, of the Prince Line of steamers, Newcastle. The vessel is constructed of Siemens-Martin steel to the highest class on the spar deck grade in Lloyd's Register. The dimensions are as follows:—Length, 350 ft.; breadth, 42 ft.; depth, 28 ft. 9 in. The vessel was named *Italian Prince*. The engines and boilers will be fitted by Messrs. Blair & Co., Limited, of Stockton.

San Ignacio de Loyola.—Following the launch on July 15th of the largest oil vessel yet built, and the largest vessel built by Messrs. Craig, Taylor & Co., in their establishment at Thornaby, viz., the s.s. *Tees*, which was of the following dimensions—355 ft. by 45 ft. by 30 ft., and which vessel will carry over 5,000 tons of oil, in addition to 700 tons of bunkers, this firm launched on Friday, July 28th, one of the smallest vessels they have yet built for the oil trade, her dimensions being 185 ft. by 31 ft. by 15 ft. 10½ in. This vessel has been built to the order of Messrs. L. Mercader & Uda de Londaiz, of San Sebastian, for their oil trade between American ports and San Sebastian (Spain), and will carry over 900 tons of oil in bulk. She is fitted with all the latest improvements, including pumping and electric light installations, fitted with patent capstan windlass by Emerson Walker & Co., and is rigged as a barquentine. Built of steel to the highest class in Lloyd's. As she left the ways she was gracefully christened the *San Ignacio de Loyola* by Sra. Gamecho, wife of the captain who takes command of the vessel.

Anthony Radcliffe.—On July 29th a vessel was launched by Palmer's Shipbuilding Co., at Howdon-on-Tyne, of the following dimensions:—Length, 315 ft.; breadth, 43 ft.; depth, 20 ft. 11 in. She is registered to carry 4,000 tons gross on a draught of 19 ft. 6 in. The vessel has been built for Messrs. Evan Thomas, Radcliffe & Co. She is schooner-rigged, built on the partial-awning deck class with full poop, and adapted to Lloyd's highest class, fitted with patent direct steam windlass by Emerson Walker & Co. She is engined by Palmer's Co., having engines of 250 H.P. As the vessel left the ways she was christened the *Anthony Radcliffe* by Miss Ethel Radcliffe, daughter of the managing owner.

Shillito.—On July 29th Messrs. J. Priestman & Co. launched at Sunderland a steel screw steamer, built to the order of Messrs. Hoggarth & Woodruff, of the Exchange, Cardiff. She is to class 100 A1 at Lloyd's, and her dimensions are as follows:—Length, 296 ft.; breadth, 39 ft. 9 in.; depth moulded, 21 ft. 2 in.; carrying capacity, 3,500 tons on 19 ft. 6 in. draught. The engines, which are triple-expansion, are by Messrs. George Clark, Limited, having cylinders 22 in., 36 in., and 59 in. by 39 in. stroke. The vessel was named *Shillito*.

Sirona.—On Saturday afternoon, July 29th, Messrs. Richardson, Duck & Co., launched from their building yard a steel screw steamer of the following dimensions, viz.:—length, over all, 317 ft. 6 in.; beam, extreme, 41 ft.; depth, moulded, 23 ft. 7 in.; tonnage, gross, about 2,920 tons. This vessel, which is the eighth built for Messrs. Carlisle & Co., of London, will take Lloyd's 100 A1 class, and has been built under special survey. She is of the raised quarter and partial awning deck type, with a short half-poop aft, accommodation for captain and officers being amidships, crew being berthed in forecastle. A cellular double bottom for water ballast is fitted throughout, and her equipment includes 5 steam winches, large donkey boiler, steam steering gear, steam windlass, by Emerson Walker & Co., stockless anchors, double derricks to hatches, and all modern appliances for speedy loading and discharging. The engines, by Messrs. Thos. Richardson and Sons, of Hartlepool, have cylinders 23 in., 37 in., and 61 in. by 42 in. stroke, steam being supplied by two single-ended boilers, having a working pressure of 160 lbs. As the vessel left the ways she was christened *Sirona* by Mrs. John Carlisle, of London.

Turret Age.—On July 29th there was launched from the yard of Messrs. Wm. Doxford & Sons, Limited, Sunderland, the *Turret Age*, the second turret steamer built to the order of Messrs. Petersen, Tate & Co., of the Sandhill, Newcastle. The first vessel built from this type—the *Turret*—was launched some eight months ago, and if then her departure was looked upon in the light of an experiment, and was subject to a good deal of criticism and forebodings, it is satisfactory to know that the *debut* of the *Turret Age* was regarded by those interested with the most sanguine expectations. The vessel has practically the same model as the *Turret*, which was the feature of last year's shipbuilding, and which was built under the patents acquired by Messrs. Doxford. She embodies, however, many improvements introduced by the builders, and may be said to possess in the most perfect sense the three essential features of the type, viz., self-trimming arrangements, large cargo capacities, and small register tonnage. Those who saw the launch were enabled to contrast the *Turret Age* with a whaleback steamer which Messrs. Doxford have almost completed after the American patents. The vessels present the widest possible difference in design, and on the score of beauty it was easy to be seen that the compact and substantial outline of the *Turret*, already depicted in these columns, will always be preferred to the whaleback, oblate, stemless hull, which, with its turrets and piled-up deck, looks more like an engine of war than an every day ship for cargo. Great as is their difference, however, the vessels have much in common as to the results to be gained, and each has its advocates as a safe, successful, cargo-carrying boat. Those of the *Turret* type are, as has been stated, very confident in the design, and after the *Turret Age* had been launched amidst the cheers of the crowd, and after Miss Tate had gracefully performed the ceremony of christening, a large number of ladies and gentlemen assembled in the offices to wish success to the vessels, the builders, and the owners. Amongst those present were Messrs. Petersen & Tate, the managing owners; Mr. Sherwood, secretary to the Turret Steamship Co.; Mr. W. T. Doxford, Mr. Chas. Doxford, Mr. Alex. Grey, Messieurs Vivet (Chef de Technique) and Gravell (chief surveyor), of the Bureau Veritas, from which the vessel has received the highest class; Mr. Warner, Shields; Mr. Nelson, Sunderland; Capt. Heathcote, R.N.; Mr. H. Hedley, Mr. A. O. Hedley; Mr. Thos. Bowden and Mr. John Bowden. Mr. Theodore Doxford briefly stated that the success of the turret type of steamer was instanced in the launch of the *Turret Age* that day. On behalf of the firm of builders he believed that she was superior to any vessel afloat for cargo-carrying purposes. Their opinion was shared by the owners, from whom they were prepared to execute as many orders for a similar class of vessel as they were prepared to favour them. Capt. Petersen said that when they launched the *Turret* eight months ago, they felt a good deal of anxiety, even though they were convinced that the principles on which she was built were as correct as theory and foresight could make them. Absolute faith in the departure, however, was only proved by practice, and he was glad to say that the test of the vessel, taken as it was under adverse circumstances, proved that their confidence in the builders was not misplaced. The practical tests to which the *Turret* had been subjected had, in fact, exceeded expectations. Yet it was not so much the sea qualities of the ship they wished to prove as her value as a money-making steamer. And here he should like to mention that she was started under the most unfavourable conditions, so far as freights were concerned. The market, indeed, was at the lowest ebb when the *Turret* took her first cargo, while, in addition, the prejudice against anything new so influenced the insurers that the premium which was forced, would almost have suggested that the underwriters regarded the *Turret* as a sort of phantom ship. But, despite all these disadvantages, the *Turret* had realised to the shareholders at the end of the first five months' working no less a dividend than 23 per cent. As to the vessel just launched, she was a very decided improvement upon the original, being not only larger, but much finer in her lines, and vastly superior in outfit and accommodation. These improvements, however, he wished to say, were only in details, and in no way interfered with the main plan of construction. The *Turret Age* is 311 ft. long 38 ft. 2 in. broad, and 24 ft. 1 in. deep. Her low draught is

19 ft., and has a carrying capacity of 3,650 tons, with a gross register of about 2,200 tons, and a net register of about 1,380 tons. Among the improvements introduced on the vessel is a new arrangement of construction of sheer strake and stringers, producing a large increase in the strength with the same amount of material. The hatches are exceptionally large, and arranged to facilitate the shipping of large pieces of machinery. Four horizontal steam winches are so fitted and arranged that two work the main hold and one each to the other holds. The machinery is fitted aft, leaving the whole of the holds amidships clear for cargo. The triple-expansion engines, fitted by Messrs. Doxford, have cylinders 23 in., 37 in., 60 in., and 42 in. stroke, working with a steam pressure of 160 lbs. They include many recent improvements.

Coquet.—On July 31st there was launched from the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesbrough, a steel screw steamer of the raised quarter deck type which has been built to the order of Messrs. J. & E. Kish, Sunderland. The principal dimensions of the vessel are; Length, 292 ft. 6 in.; beam, 40 ft. 6 in. by 22 ft., depth moulded, with a large deadweight carrying capacity. Engines will be fitted by the North-Eastern Marine Engineering Co., Limited, of Wallsend-on-Tyne, the cylinders being 22 in., 36 in., 58 in., by 39 in, with 2 large boilers working at 160 lbs. pressure. The construction of the vessel has been under the superintendence of Thomas Metcalf, Esq., of Sunderland, and as she was leaving the ways she was named the *Coquet* by Miss Annie Kish, sister of the owners.

Pfalz.—On July 31st Messrs. Wigham Richardson & Co., launched, at Newcastle-on-Tyne, a steel screw steamer called the *Pfalz*, which they are building to the order of the Norddeutscher Lloyd, of Bremen, for their mail and passenger line between Bremen and the River Plate. The vessel is 376 ft. in length by 43½ ft. beam, and has accommodation for 50 first-class passengers and about 800 emigrants. The engines are on the triple system.

Sutterton.—On Tuesday, August 1st, there was launched from the yard of Earle's Shipbuilding and Engineering Co. Limited, Hull, for the Boston Deep Sea Fishing and Ice Co., Limited, the fine iron screw trawler *Sutterton*, 100 ft. long, 20 ft. 6 in. beam, and 11 ft. depth to top of floors. She is built to Lloyd's highest class, with short raised quarter-deck and forecastle, and has all the most recent improvements for steam fishing, including patent trawl ports, dandy scores, and steam winch of Messrs. Earle's special design. Her engines are of the triple-compound type with cylinders 11 in., 17 in., and 30 in. diameter, by 21 in. stroke, and she has a large steel boiler to work at a pressure of 150 lbs. per square inch.

Lemgo.—On Friday afternoon, August 11th, Messrs. The Blyth Shipbuilding Co. Limited, launched from their Shipbuilding and Graving Dock Works at Blyth, a large steel screw steamer of the partial awning deck type, for Newcastle owners. The principal dimensions of the *Lemgo* are as follows:—Length, 293 ft.; breadth, 39 ft., and of light draught with cellular double bottom for water ballast. Hold beams have been dispensed with, and strong web-frames fitted, thus enabling very bulky cargoes to be shipped. The frames are of bulb angles, without reverse bars, and to Lloyd's scantlings. The captain's and officers' accommodation is fitted up in a large and commodious house on deck amidships, the engineers are under the bridge, whilst the crew are berthed under the awning deck forward. The deck machinery embraces all the latest types and improvements in this class of work, and consists of Wigham's powerful helical winches to each hatch, Donkin & Co.'s patent steam steering gear, with screw gear aft, and Emerson Walker's patent windlass for working the anchors. The vessel is schooner rigged with telescopic topmasts. Triple engines of large power are being built by Messrs. G. Clark, Limited, of Sunderland, and will be put on board immediately. The christening ceremony of naming the steamer *Lemgo* was gracefully performed by Mrs. Ralph Marshall, of Jesmond. After the launch the owners and friends adjourned to the company's offices, when the usual toasts were proposed.

H.M.S. Havock.—On Saturday, August 12th, H.M.S. *Havock* was safely launched from the works of Messrs. Yarrow & Co., at Poplar. This vessel is the first of the new type of torpedo boat destroyer being constructed for the Admiralty, and from which an exceptionally high speed is expected. She is 180 ft. length, and will have a displacement of about 220 tons.

No. 1" Pontoon.—On August 12th an immense pontoon which has been built to the order of the Manchester Ship Canal Pontoons and Dry Dock Co., Limited, was launched from the yard of Edwards' Shipbuilding Co., at Howden. The pontoon is 300 ft. long, has an extreme breadth of 70 ft., and the depth of towers is 31 ft. 6 in. The tanks are divided into 40 watertight compartments, which are filled from four inlet valves, two on each side. The engines are placed in the fore end towers, and there are two centrifugal pumps by Tangye, with 21-in. suction. Each pump is driven by a horizontal engine with cylinders 13 in. in diameter by 18 in. stroke. The two boilers, of Siemens-Martin steel, are from the establishment of Messrs. Eltringham, South Shields. The pontoon is of iron throughout, and it has been constructed under the personal superintendence of Mr. Alex. Taylor, the patentee, and Mr. Harrold, for the Dock Co., while Mr. Sharer and Mr. Swan, for the builders, have devoted great care to the construction. The company for which it has been built, and which consists largely of local capital, has been formed for the purpose of repairing ships at Mode Wheel Dock, Manchester, and at Ellesmere port, Cheshire. There was a large attendance at the launch, including Mr. Geo. Renwick, J.P., chairman of the new company; Mr. Alex. Taylor, patentee; the Mayor of Tynemouth (Alderman J. F. Spence); the Mayor of South Shields (Alderman Rennoldson); Alderman Eltringham, South Shields; Mr. C. Wesencraft; Mr. Pilditch (Palmer & Co.); Mr. John Bowman, J.P.; Mr. Benjamin Plummer, jun.; Mr. R. B. Peverley, and a large number of others, including many ladies. The craft was named the "No. 1" by Mrs. Renwick, and as it moved slowly and splendidly into the water of the Tyne there were loud cheers from the crowds that occupied every point of vantage at both sides of the river. The pontoon was afterwards towed a little down the Tyne, and during the present week it will be taken by tugs to its destination.

Perthshire.—On August 12th Messrs. Hawthorn, Leslie & Co., Limited, launched the largest carrying steamer yet built in their shipyard at Hebburn-on-Tyne. The vessel is one of two sister ships in process of construction at this yard, and is of the large dimensions of 430 ft. by 54 ft. by 32 ft. She is built to the order of Messrs. Turnbull, Martin & Co., of London and Glasgow, for their Australian trade, and specially fitted for carrying frozen meat, with powerful duplicate refrigerating machinery of Messrs. Linde's system and large insulated space of a capacity of nearly a quarter of a million cubic feet is provided in the holds forward of machinery space, leaving all the after holds available for general cargo. She is classed at Lloyd's 100 A1, and is schooner-rigged, with two masts. The machinery, which is being constructed by the same firm at St. Peter's Works, consists of a set of triple-expansion engines, capable of indicating upwards of 3,000 H.P., with two large single-ended steel boilers, working at a pressure of 160 lbs. per square inch. These boilers are to be worked under the induced draught system patented by Messrs. John Brown & Co., of Sheffield, and are also fitted with their patent Serve boiler tubes. The construction of the vessel and machinery has been carried out under the superintendence of Mr. John Wotherspoon, assisted by Messrs. Campbell and Weir. On leaving the ways Mrs Wotherspoon, the wife of the owners' representative, named the vessel *Perthshire*.

Queen Louise.—On Aug. 12th there was launched from the Sunderland yard of Messrs. Bartram & Haswell a large screw steel steamer, built by them to the order of Messrs. Thomas Dunlop, of Glasgow. The vessel is on the spar-deck type, with poop, long bridge, and topgallant-forecastle, and is of th following dimensions:—Length over all, 340 ft.; breadth, 42 ft 6 in.; with a depth of 29 ft. 8 in. She has been built to take the highest class in Lloyd's Register under the supervision of Captain A. Jack, on behalf of the owners. The double bottom is on the cellular principle, and is divided into five tanks for water ballast. She has been specially strengthened under the boilers, and all through her construction is of the most robust type. The vessel is partitioned into five holds, with six watertight bulkheads, in addition to having a strong wood bulkhead for the cross bunkers. The deck machinery consists of five large steam winches, which are supplied with steam from a horizontal multitubular boiler. The steam steering gear is placed in the engine-room, and is worked from the bridge. The poop has been handsomely fitted up with various polished woods and affords accommodation for about a dozen passengers, together with the steward and officers' berths. The captain has a commodious house on the bridge, with direct communication with the chart-room. The vessel will be supplied by engines from the yard of Messrs. John Dickinson &

Sons. The cylinders are of 24 in., 39½ in., and 65 in., with a stroke of 42 in. The boilers are single-ended, for the purpose of giving extra power. During construction the machinery has been superintended by Mr. D. M'Gregor, of Glasgow. By permission of her Majesty the Queen of Denmark the vessel has been named *Queen Louise*, the christening ceremony being performed by Miss Louise Dunlop, of Egremount, Helensburg.

Wallsend.—On August 12th Messrs. Wood, Skinner & Co. launched from their shipbuilding yard, at Bill Quay, a fine steel screw steamer named the *Wallsend*, built to the order of Messrs. Burnett & Co., of Newcastle. The steamer is constructed to attain the highest class in Lloyd's register. She is 217 ft. in length by 30 ft. beam, and 16 ft. depth moulded, and is specially designed for the coal trade, having extra large hatches. The vessel is of the raised quarter-deck type, and has water ballast in the cellular double bottom all fore and aft, and in the fore and after peaks. She will be rigged as a fore and aft schooner, with fiddled topmasts for passing under the bridges of the Manchester Ship Canal. All the most recent appliances for working the ship are fitted, as well as for the rapid loading and discharging of cargo, fitted with patent direct steam-windlass by Emerson, Walker & Co. The engines, which are of triple-expansion type, will be fitted by the North-Eastern Marine Engineering Company. The cylinders are as follows: 17, 28, and 46 in., with 30 in. stroke, capable of propelling the vessel at a speed of 10 knots loaded. Both the ship and engines have been superintended during the construction by Mr. Norman Burnett, of Newcastle. The act of naming was performed by Miss Philipson, of Tynemouth.

Menantic.—On August 15th there was launched from the shipbuilding yard of Messrs. J. L. Thomson & Sons, a very large and handsome steamer, which has been built to the order of Messrs. T. Hogan & Sons, New York, for their Manhanset Line, between Avonmouth and New York. She is a sister ship to the *Massapequa*, which was launched on the 27th ult. The construction and fitting-out of the vessel have been entrusted to Captain T. H. Gore, of Bristol, the local manager for this company. As the vessel left the ways she was named *Menantic* by Miss Gertrude Pinkney, daughter of Mr. T. W. Pinkney, manager of the Baltimore Line, running to Bristol.

Cayo Mono.—There was successfully launched on August 17th from the West Yard of the firm of Messrs. C. S. Swan & Hunter, shipbuilders, Wallsend, a handsome screw steamer measuring 325 ft. in length, 41 ft. in breadth, with a moulded depth of 26 ft. 10 in. The vessel, which has been built under special survey, and will be registered in the highest class at Lloyd's, has been built to the order of Messrs. Ernest Bigland & Co., London. She has been constructed on the Spar deck type, with long poop, long bridge, and topgallant forecastle. Her water ballast arrangement is on the cellular double bottom principle, with six watertight bulkheads. Her frames are extra strong amidships, and hold beams and webs have consequently been dispensed with. All the latest improvements have been introduced. The officers will be berthed under the bridge and the crew in the forecastle, and the accommodation for both is exceptionally spacious and well ventilated. The vessel is intended for a line carrying general cargo. Her engines have been built by Messrs. Thomas Richardson & Sons, of Hartlepool, the dimensions of the cylinders being 24 in. 38 in. and 64 in., with a stroke of 42 in., the guaranteed speed loaded being 11 knots per hour. On leaving the ways the vessel was named the *Cayo Mono*, by Mrs. Drury, wife of Dr. A. Drury of Halifax.

Maori.—There was successfully launched on August 14th, from the east yard of the firm of Messrs. C. S. Swan & Hunter, shipbuilders, Wallsend, a finely modelled steel screw steamer of the following dimensions:—Length, 415 ft. over all; breadth, 48 ft., depth moulded, 32 ft. 6 in. The vessel, which has been built to the order of Messrs. The Shaw, Savill & Albion Co., Limited, London, has been specially constructed for the Colonial Frozen Meat Trade, and all the latest improvements have been introduced. She is built on the three deck type, with poop, long bridge house, and long topgallant forecastle. Water-ballast is provided on the cellular double bottom principal throughout, and she has six watertight bulkheads. The deck machinery includes 8 powerful steam winches. Her engines have been made by the Central Marine Engineering Co., West Hartlepool, the dimensions of the cylinders being 29 in., 46 in. and 77 in., with a stroke of 48 in. On leaving the ways the vessel was named the *Maori* by Mrs. Henderson, wife of Canon Henderson, M. A., Rector of Wallsend.

LAUNCHES—Scotch.

Miltonburn.—On July 26th Messrs Barclay, Curle & Co., Limited, launched at Whiteinch, on the Clyde, a large four-masted steel sailing barque, which has been built for Messrs. Shankland & Co., Greenock. The vessel was named the *Miltonburn*. The dimensions are:—Length, 297 ft.; 45.2 by 25.7. The ship, which is intended for general trade, measures about 2,500 tons.

Olive.—On July 26th Messrs. D. & W. Henderson & Co launched at Partick, on the Clyde, the *Olive*, a steel screw steamer of 1,100 tons, for the Glasgow, Dublin, and Londonderry Steam Packet Co. Her dimensions are:—Length, 260 ft; breadth, 33 ft.; and depth, 16½ ft. The vessel will be supplied by the builders with triple-expansion engines having cylinders 26, 42, and 68½ in. diameter, with a stroke of 45 in. The *Olive* has been provided with accommodation for 100 first-class and a large number of steerage passengers; while on the main and 'tween deck stalls are fitted up for cattle, with artificial ventilation by means of fans. The vessel is to be lighted electrically. The naming ceremony was performed by Miss M'Lellan, daughter of Mr. Lewis M'Lellan, chairman of the Company.

Japan.—On July 29th Messrs. Caird & Co. launched at Greenock a steel screw steamer, named the *Japan*, for the P. and O. Co., her dimensions being as follow:—Length, 397 ft.; breadth, 45 ft.; and depth 31 ft. She is of 4,300 tons gross, with a carrying capacity of 5,500 tons, and will be supplied by the builders with triple-expansion engines of 3,000 effective H.P. The *Japan* is furnished with all the most approved appliances for the handling of cargo. She is fitted throughout with the electric light, and has superior accommodation for 50 passengers, for whose convenience there is everything that can be desired. It may be of interes to state that the *Japan* makes the 34th vessel built by Messrs. Caird & Co. for the P. and O. Co., the aggregate tonnage of these vessels amounting to close on 160,000 tons. It may be further remarked that since and including the jubilee year (1887) Messrs. Caird & Co. have constructed for the same great shipowning concern no fewer than 13 vessels of an aggregate tonnage of 61,794 tons, of an effective H.P. of 66,000, and at a cost of within a fraction of £2,000,000.

Oolong.—On Saturday afternoon, July 29th, the London and Glasgow Engineering and Iron Shipbuilding Co., Limited, launched a steel screw steamer for the China Mutual Steam Navigation Co., Limited. The dimensions of the vessel are as follow:—Length, 360 ft.; breadth, 44 ft.; and depth of hold, 29 ft. 6 in., of 5,720 tons capacity, and has been specially designed and constructed for the China trade. The engines, also supplied by the builders, are of the triple-compound type, having cylinders 24½ in., 39 in., and 64 in. diameter by 48 in. stroke. The boilers are two in number, each having three furnaces, working pressure, 160 lb.; and they will be worked by Howden's system of forced draught, which is arranged on the most approved method. The arrangements for the loading and discharging of cargo and the handling of the ship are of the most efficient description that experience can suggest. Steam winches, both double and single, by Messrs. Clarke, Chapman, & Co., are fitted at each hatch; steam windlass by same makers; the steam steering gear, Harrison's patent, and most powerful hand gear. As the vessel entered the water she was named the *Oolong* by Miss Harriet Stewart, daughter of Mr. H. D. Stewart, of Strathgarry, Blair Athole, one of the directors of the China Mutual Steam Navigation Co., Limited.

Elizabeth.—On July 31st Messrs. Russell & Co. launched at Port Glasgow the three-masted barque *Elizabeth*, of 340 tons nett, to carry 600 tons. This vessel has been built to the order of Messrs. Peterson, Honeyman, and Co., Glasgow.

Levernbank.—On July 31st Messrs. Russell and Co. launched the four-masted steel sailing barque *Levernbank*, built to the order of Messrs. Andrew Weir and Co., Glasgow. She is of 2,200 tons register, and will carry 3,800 tons deadweight.

Glenbank.—On August 1st Messrs. Anderson, Rodger, & Co. launched at Port Glasgow the steel sailing barque *Glenbank*, of 1,400 tons register, and 2,540 tons carrying capacity. The dimensions of the vessel are 240 ft., by 37 ft., by 21 ft. 7 in. The ship has been built for the Glenbank Shipping Co.

Ossifrage.—On August 1st a new steam liner was launched by Mr. James Millar, at St. Monans. The vessel was named the *Ossifrage*. Her dimensions are:—Length over all, 95 ft.; length of keel, 85 ft.; breadth of beam, 18 ft.; depth of hold 10 ft. 6 in.

Energy and Expedient.—On July 3rd Messrs. Mackie & Thomson launched at Govan the *Energy* and the *Expedient*, two fleeters of 150 tons, built for the Great Northern Steam Fishing Co., Hull. They are each 100 ft. long, 20 ft. 6 in. broad, and 11 ft. 7 in. deep, and have compound engines, with cylinders 15 and 30 in. in diameter, and a stroke of 20 in. Messrs. Muir & Houston, Kinning Park, supplied the machinery.

Grome.—On August 2nd Messrs. Marshall & Co. launched at Kelvin Dock, Maryhill, a steel screw steamer of 130 tons, to the order of Messrs. Richard Munro & Co., 160, Hope Street, Glasgow, for their canal and coasting trade. She was christened the *Grome*, and will be engined by Messrs. James Donald & Son, Paisley.

Bourbon.—On August 3rd Messrs. Charles Connell & Co. launched at Scotstoun the *Bourbon* (s.), which they have built to the order of the Liverpool and Maranham Steamship Co., Limited, Liverpool. This vessel has been built to class in the highest grade both in Lloyd's and Bureau Veritas. Her dimensions are:—260 feet on water line, by 35 ft. by 22 ft., measuring about 1,600 tons. Her engines of the triple-expansion type, with cylinders 20 in. 33 in. and 54 in. by 42 in. stroke, are being supplied by Messrs. Dunsmuir & Jackson, Govan.

Sailing Vessel.—On August 3rd Messrs. Russell & Co. launched at Greenock a sailing vessel, constructed to carry about 2,750 tons deadweight, and of the following dimensions:—Length, 246 ft.; breadth, 37 ft. 6 in.; and depth, 22 ft. 6 in.

Therese et Marie.—On August 9th there was launched by Messrs. Archibald M'Millan & Son, Limited, at Dumbarton, a steel screw steamer of about 1,600 tons, which has been built to the order of Messrs Worms, Josse & Co., and is intended for their Continental trade. The steamer was named the *Therese et Marie*.

Christabel.—On August 10th Messrs. David & William Henderson & Co., launched at Partick the steel screw steam yacht *Christabel*, which they have built to the order of Mr. A. C. Kennard, 17, Eaton Place, London, from designs of Mr. G. L. Watson. The principal dimensions are:—Length over all, 160 ft.: breadth, 22 ft.; depth, 13 ft. 8 in. The vessel has been built to the requirements of Lloyd's for classification in their yacht register. The cabin arrangements are of the most complete description, and the details and fittings have been designed by Mr. T. L. Watson, A.R.I.B.A., Glasgow. The dining saloon is aft, and is of large size, panelled in oak. The upholstery is in handsome Utrecht velvet. The saloon is complete with dining tables and chairs, bookcase, cabinets, sideboards, writing-table &c., all in polished oak. Immediately forward of the dining-saloon is the owner's room, a large and handsomely furnished apartment. The lower part of the bulkheads is of polished oak, with arras above. The room contains a bath, handsome dressing-table and mirror, writing-table, sofa, wardrobe, &c. The upholstery is the same as in the dining saloons. There are five other state-rooms of smaller size but furnished in similar style. All the berths are fitted with spring mattresses. The floors in saloon, state-rooms, lavatory and passages are laid with parquet flooring. The passages are all panelled in oak. A passage alongside the machinery casing allows access to the dining-saloon from the forward state-rooms without going on deck. The crew's quarters are forward, being separated from the state-rooms by a watertight bulkhead. There are separate rooms for the captain, mate, and engineer, with a mess-room and pantry. A large forecastle for the crew is fitted up with folded berths, tables, lockers, &c. The vessel is rigged as a two-masted fore and aft schooner with pole masts, sails and awnings. The machinery is being made by the builders, and consists of a set of triple-expansion engines, with cylinders 13 in., 20 in., and 33 in. diameter, by 24 in. stroke. The main boiler works at a pressure of 160 lbs. A donkey boiler is also fitted for supplying steam to the windlass and steering gear.

Rutland.—On August 10th there was launched by Messrs. Barclay, Curle & Co., Limited, at Whiteinch, a steel screw steamer, intended for general trade between Liverpool and Hamburg. The vessel has been built to the order of the Liverpool and Hamburg Steamship Co., Liverpool (Messrs. Donald Currie & Co., managers), and constructed over the requirements of the 100 A1 class in Lloyd's Register. Her dimensions are:—255 ft. by 34 ft. by 23.6 and measures about 1,400 tons gross. The vessel was named the *Rutland*.

Twin-screw Hopper Steamer.—On Thursday, August 10th, Messrs. Wm. Simons & Co., Renfrew, launched, complete from their yard, the last of the four barges recently ordered by the Clyde Trustees, from the joint specification of Mr. Deas, their engineer-in-chief, and Mr. Baxter, their mechanical engineer. The leading particulars of which are:—Length, 205 ft.; breadth, 35 ft.; depth, 15 ft. 6 in. The hopper has a capacity for 1,200 tons of material. The vessel is propelled by two sets of triple-expansion engines, and twin-screws capable of attaining a speed of 10½ knots per hour when loaded. It is built under the British Corporation requirements and survey, and is a duplicate of "No. 21," lately launched by the builders for the same owners. The ceremony of naming the vessel "No. 22 C.N." was performed by Miss Deas, daughter of Mr. James Deas, C.E., engineer to the Clyde Trust. At the luncheon which followed, Mr. Andrew Brown, the senior partner of the firm, proposed "Miss Deas' health and success to the barge," which was heartily responded to, and replied to by Mr. Deas, who, after thanking Mr. Brown and the company for the honour they had done his daughter, and stating that Messrs. Simons & Co.'s name and fame as the constructors of dredging plant was world wide, and that harbour and river authorities were under a deep debt of gratitude to them for enabling them expeditiously and cheaply to deepen and otherwise improve navigable rivers and extend harbours to meet the ever-growing necessities of the shipping trade of the world, made some interesting remarks, mentioning that this was the twenty-fourth barge that had been built for the Clyde Trustees, of which number Messrs. Simons had built eight, having built the first of that large fleet, a single-screw, in 1862, with a hopper capacity of 240 tons and 35 N.H.P., and the last, a twin-screw, launched to-day, of 1,200 tons hopper capacity and 160 H.P., and that, in consequence of the fatal collision below Bowling in 1889 when the Trustees "No. 6" was run down and sunk, with the loss of six valuable lives, they were able to dispose of at £2,250 each, after twenty-seven years constant service, of two of the first barges built by Messrs. Simons, the original cost of which was £4,000 each, thus bearing indisputable testimony to the admirable quality of Messrs. Simons & Co.'s material and workmanship and to the thorough manner in which the barges had been maintained. Up till the year 1862, Mr. Deas further said, the whole of the dredged material was loaded on to punts, and from these discharged chiefly under contract on to land adjoining the river, and by throwing overboard at certain places below high water-mark on both sides of the channel below the river Leven, the average cost for depositing harbour dredgings, including the use of punts, towing, &c., being 10·04 pence per ton, or 1s. 0½d. per cubic yard exclusive of the rent paid to the riparian proprietors while the work was in progress, and the total quantity dredged for the year ended 30th June, 1861, was 593,176 cubic yards. On 28th August, 1862, depositing in Loch Long, on an area 428 acres in extent, laid down by the Admiralty on an Admiralty chart was inaugurated by Messrs. William Simons & Co.'s first hopper barge, the Admiralty having required that the material lifted by one of the Clyde Trustees' dredgers at the request of the Cumbrae Lighthouse Trust in the widening of the navigable channel opposite to Garvek Point, Greenock, should be deposited there. The economy and facility of this mode of disposing of the dredged material was so marked that the Trustees gradually increased their barge plant, until in August, 1877, the fleet numbered 18, and the quantity dredged in the year ended 30th June, 1877, rose to 965,468 cubic yards, and since then has never been under 1,000,000 cubic yards in any year; the quantity lifted during the year ended 30th June last amounting to 1,841,000 cubic yards, being the largest quantity ever dredged in twelve months. But for the adoption of hopper barges, it is generally admitted by all capable of forming a correct opinion, that the river both within the jurisdiction of the Clyde Trustees and of the Clyde Lighthouses Trustees, could not, even for financial reasons, have been widened, deepened, and otherwise improved as it has been. The deposit of dredgings in Loch Long continued gradually to increase with the increasing number of hopper barges until for the year ended 30th June, 1890, 1,367,840 cubic yards of the whole quantity of 1,418,512 cubic yards dredged in that year were deposited in Loch Long. For twenty-five years the use of Loch Long as a place of deposit was uncomplained of by anyone, and would in all likelihood have so continued but for the unfortunate action of the North British Chemical Co. commencing to discharge on the surface of the Loch, from steam lighters, most offensive waste products from their works on the Forth and Clyde Canal at Clyde-

bank. The effluvia caused by the contact of this waste with the salt water was so offensive that residents on the sides of the Loch complained, not only against this noxious deposit, but also against the deposits made by the Clyde Trustees, and ultimately so influenced the Lord Advocate that he was induced by them on 6th February, 1891, to raise a summons against the Trustees to interdict and prohibit them from continuing depositing there, and after lengthened negotiations with the Board of Trade, the Trustees on 18th March last consented to the Crown being granted interdict against them depositing material dredged from the harbour and river, on the condition that the excavations from Cessnock Dock should be allowed to be continued to be deposited there, and that the harbour and river dredgings should be permitted to be discharged three miles seaward of Garroch Head, on the Island of Bute, and on the 20th of that month the depositing of the whole of the harbour and river dredgings seaward of Garroch Head was commenced. The total quantity of material deposited in Loch Long by the Clyde Trustees up to and including 18th March, when the depositing there of the harbour and river dredgings ceased, amounted to 30,226,388 cubic yards, to which falls to be added large quantities deposited by the Clyde Lighthouses Trust, the Greenock Harbour Trust, the Dumbarton Harbour Trust, and the Cart Trustees "Continued prosperity to the firm of Messrs. William Simons & Co.," proposed by Mr. Deas, was replied to by Mr. Wm. Brown, son of the senior partner, who proposed "the Clyde Trustees," coupled with the name of Mr. William Robertson, steamship owner, Glasgow, one of that important body, who in responding stated that, a native of Renfrew, he began his career in the very yard in which he was then speaking, and bore testimony to the desire of the trustees to do everything in their power to meet the wants and ever-growing demands for river and harbour accommodation. Mr. Robertson subsequently proposed "Mr. W. T. Courtier-Dutton, chief surveyor, the British Corporation for the Survey and Registry of Shipping, to whose requirements the four last barges have been built, and of Mr. Baxter, the Trustees Mechanical Engineer," both of whom replied, following which Mr. Robertson proposed "the health of Mr. Deas" in very appreciative terms, who in reply mentioned that he had nearly completed a quarter of a century's service with the Trustees; that since he joined the service the river had been deepened all the way from Glasgow to Port-Glasgow upwards of five feet; that in the earlier years of his connection with the Trust groundings of moderately drafted vessels were of almost daily occurrence, and that for every inch of additional depth obtained the steamship owners took two inches, but that now, groundings were practically unknown, in proof of which he stated that the *Campania* and the *Lucania*, each drawing about 26 ft., had passed down the river without interruption or delay in less than three hours, that the quayage of the harbour in 1869 was less than three miles, that it is now upwards of six miles, that the revenue then was £150,000, that it is now £368,000, that then cabbage grew and sheep pastured on the side of the Queen's Dock, some of the ground of which was 43 ft. above the quay level, where it is now 40 ft. below, and that the quay walls built within the last 25 years on concrete cylinders had practically cost nothing for repair. "The health of the ladies," proposed by Mr. Andrew Brown, and replied to by Mr. McDowall, of Messrs. McDowall & Neilson, terminated the proceedings.

Enterprise and Economy.—On August 14th Messrs. Mackie and Thomson launched from their yard at Govan the *Enterprise* and the *Economy*, two fleeters of 150 tons, built for the Great Northern Steam Fishing Co., Hull. These vessels, which are identical with the *Energy* and *Expedient*, launched at the end of last month from the same yard, differ from the ordinary trawlers in respect that while the latter return to port at least once a week, the fleeters remain at sea as long as their coals hold out, transferring their catches to cutters. They are each 100 ft. long, 20 ft. 6 in. broad, and 11 ft. 7 in. deep. They will be supplied by Messrs. Muir & Houston with compound engines, having cylinders 15 in. and 30 in. in diameter, and 20 in. stroke.

Mayflower.—On August 14th Messrs. Marr Brothers, Leith, launched from their upper yard at Junction Bridge, a wooden steam line fishing boat named the *Mayflower*, built to the order of Captain Young, North Shields. The dimensions are:—Length 86 ft. between perpendiculars, breadth 19 ft., depth 10 ft.

St. Bernard.—On August 14th the Grangemouth Dockyard Co. launched from their shipbuilding yard at Grangemouth, a handsomely-modelled steam trawler of the following dimensions:—Length, 117 ft. by 21 ft. breadth, by 12 ft. depth; built of steel to class 100 A1 at Lloyd's, under special survey. On the vessel taking the ways she was gracefully named the *St. Bernard* by Miss Muirhead, of Malta House, Edinburgh. The *St. Bernard* has been built to the order of Mr. James Muirhead, merchant, Edinburgh, and is intended to be engaged in the trawling business on the East Coast, and will be fitted up with all the latest improvements for this business, including all requirements to meet the new fisheries laws. The engines are being fitted by Messrs. Hutson & Son, Kelvinhaugh Engine Works, Glasgow, and are expected to drive her fully 12 knots speed with a full cargo of fish, speed being of the utmost importance to enable the vessel to deliver her fish in first-class order. The *St. Bernard*, when completed is expected to be the largest, most powerful, and up-to-date steam trawler afloat, and Mr. Muirhead is to be congratulated on the enterprise he has shown in this direction. Amongst those present at the launch were Mr. James Muirhead, Mrs. Muirhead, and the Misses Muirhead, of Malta House, Edinburgh; Mr. Guybon Hutson, jun., Glasgow; Dr. Higgins, Edinburgh; Mr. Muirhead, jun.; Mr. James Moncur, surveyor to Lloyd's Register, Leith; Mr. Spence and Mr. Miller of the Dockyard Co. After the launch a cake and wine banquet was held in the builders' offices, when the usual toasts were proposed and duly honoured. Immediately after the launch the vessel left for Leith under tow to ship her boilers; afterwards to be brought back to the dockyard to finish.

Dalrymple.—On August 15th the Ailsa Shipbuilding Co. launched from their yard at Troon a handsome steel sailing barque for Messrs. John M. Campbell & Son, Glasgow. The following are her principal dimensions:—Length, between perpendiculars, 247 ft.; breadth, moulded, 38 ft.; depth (moulded), 23 ft.; and she will have a deadweight carrying capacity of about 2,700 tons. She has been built under special survey and to Lloyd's highest class, and will be furnished with the usual modern appliances and outfit, including Hastie's patent halyard winches for both top-sails and topgallant sails. The construction of the vessel has been superintended by Captain Buyers. On leaving the ways the vessel was named *Dalrymple* by Miss Kate Campbell, Southpark, Hillhead, Glasgow. An adjournment was afterwards made to the moulding loft by a large party of friends of the owners and builders, when the usual toasts were given.

Villam.—On August 15th Messrs. Gourlay Brothers & Co., Dundee, launched from Camperdown Shipbuilding yard a steel screw steamer, built to the order of Mr. Leopold Schwartz, of Fiume. The *Villam*, as the steamer has been named, is about 650 tons gross register, her dimensions being:—Length, 222 ft.; breadth, 28 ft. 6 in.; depth, moulded, 11 ft. 3 in. She is built with a long poop, which extends beyond midships, and a fairly long forecastle, with a well-deck intervening. The topgallant forecastle is connected with the poop by a gangway. In the poop the *Villam* has accommodation for about 40 first-class passengers. A teak deck-house on the poop forms the entrance to the saloon and also the smoking-room. The engineers' and officers' quarters are in a deck-house on the front of the poop, underneath the flying bridge, while the captain's apartments are in a teak deck-house amidships. The forecastle is fitted up for carrying second-class passengers, while the crew are quartered beneath the forecastle. Water ballast is carried under the afterhold and in the forepeak. The *Villam* has triple-expansion engines, with cylinders of 19 in., 32 in. and 52 in., and a piston stroke of 36 in. The boiler has been constructed for a pressure of 160 lbs. to the square inch. The *Villam* has been built to carry passengers, mails and general cargo between Fiume and the Adriatic Sea.

Glenclova.—On August 17th Messrs. Charles Connell & Co. Scotstoun Shipyard, Whiteinch, launched a nicely modelled steel sailing ship, 283 ft. by 43 ft. by 26 ft., and measuring about 2,300 tons, to the order of the Dundee Shipowners' Co., Limited. She has been built to the highest class in Lloyd's, rigged as a four-masted barque, and is fitted with all the most improved appliances for the handling of ship and safety of both crew and cargo, including patent capstan windlass by Emerson Walker & Co. As the vessel left the ways she was named *Glenclova* in the customary manner by Miss Watt, daughter of Captain Watt, the commander of the ship.

Calchfaen.—On August 19th the Ailsa Shipbuilding Co., Troon, launched a steel screw steamer for Messrs. Kneeshaw, Lupton & Co., Liverpool. The vessel has been built under

special survey and classed 100 A1 at Lloyd's, and is of the following dimensions:—Length, over all, 167 ft.; length, between perpendiculars, 160 ft.; breadth, moulded, 24 ft. 6 in.; depth, moulded, 11 ft. 9 in.; depth of hold, 10 ft. 11 in. She will be fitted by the builders with compound surface-condensing engines, having cylinders 20 in. and 40 in. diameter by 27 in. stroke. The vessel as she left the ways was named *Calchfaen* by Miss Guthrie, Troon.

Rappahannock.—Recently the Chesapeake & Ohio Steamship Co., Limited, whose registered office is in London, and in which the Chesapeake & Ohio Railway are largely interested, was formed for the purpose of running a line of superior boats between Newport News and the ports of Liverpool and London. Newport News possesses special advantages, among these being an unlimited supply, at cheap prices, of the finest coal in the world. The harbour is beautifully sheltered, can be entered at all states of the tide, and has splendid facilities for loading and discharging, while from its position on the Chesapeake coast, and being the terminus of the Chesapeake & Ohio Railway, and connected with the Cleveland & Cincinnati and St. Louis Railway, and other railway systems, the port is the natural outlet for the trade of one of the largest and most important geographical divisions of the United States, besides having direct communication with Chicago and the West. The agents appointed in Newport News and London are Messrs. Furness, Withy & Co., Limited, and at Liverpool Messrs. John Glynn & Son. The standing and experience of these firms is a guarantee to shippers that at all ports their interests will have the best possible attention. The company wisely determined from the first to make its fleet worthy of the trade, and with this in view they ordered six first-rate steamers, specially designed for carrying cattle and general cargo quickly, economically and safely. The construction of the three largest of these was entrusted to Messrs. Alexander Stephen & Sons, one of the oldest and most experienced firms on the Clyde; and the first of these three, the s.s. *Rappahannock*, was launched from the Building Yard at Linthouse on Thursday, July 27th. The *Rappahannock* is built of steel, and largely in excess of Lloyd's rules for their highest, or 100 A1 class. She is 370 ft. long between perpendiculars; 44 ft. broad; and 31½ ft. deep, and her deadweight carrying capacity is between five and six thousand tons. The spaces between poop bridge and forecastle are provided with a shelter deck, so that cattle can be carried under cover there as well as on the deck next below. Under the latter the holds are suitable for receiving all kinds of cargo including the largest and heaviest descriptions; while the appliances for rapidly loading and unloading are of the most complete and effective kind. A specialty of the vessels is the superior character of the cattle fittings. These provide for carrying about 760 head of cattle, and may safely be said to be the best yet put into any ship afloat. The two decks devoted to cattle have these fittings throughout, so arranged that when cattle are not carried the fittings can be slung up so as to make a clear hold for cargo. They have been supplied and fixed on board by Mr. Wm. Wylie, Glasgow, and have all been approved by the U.S. Board of Agriculture. The two cattle decks have been cemented all over. A most perfect system of piping is carried throughout the cattle spaces, affording at all times an easy means of carrying a copious supply of water to the animals. The ballast tanks under engines and boilers have been subdivided into small sections and will be utilized for carrying fresh water for cattle purposes, so avoiding the use of condensed water (although there are ample appliances on board for condensing sufficient water if at any time required). The ventilation has been carefully attended to and is far in excess of the American cattle trade requirements. The vessel is also lighted throughout by electricity, and no expense has been spared to make the ship in every respect a most suitable one for the trade. The accommodation for captain, officers and crew, is commodious and in good taste. The saloon is in polished hardwood and fitted up in a chaste style. There are spare rooms of a very comfortable kind for a limited number of first-class passengers. Special quarters are provided for the crew, forward, and for the cattlemen in the after part of the vessel. The whole of the accommodation is heated by steam. The engines, which are also built by Messrs. Stephens, and were put on board before launching, are of the triple-expansion type, with every modern improvement. The cylinders are of 28 in., 46 in., and 75 in. diameter, by 54 in. stroke, and they are supplied with steam at 160 lbs. pressure. The power developed will give a very satisfactory sea speed. The vessel has been built throughout under the advice and personal supervision of Mr. Geo. McFarlane, the owners' consulting engineer, and Captain Manley, their marine superintendent. The vessel was gracefully named the *Rappahannock*, by Mrs. Mackenzie, wife of Mr. Colin J. Mackenzie, L.L. Therfield, Peebles, one of the Directors of the Chesapeake and Ohio Steamship Co. Afterwards the launch party adjourned to the builders' office. Mr. Alex. Stephen presided, and among those present were Mr. and Mrs. Mackenzie, Mr. Walter Glynn, Liverpool, Managing Director of the Leyland Line, and Director of the Chesapeake and Ohio Steamship Co.; Captain King, West Hartlepool; Mr. George McFarlane, Capt. Manley, Mr. J. B. Murray, Glasgow; Mr. A. E. Stephen, and Mr. F. J. Stephen. The Chairman proposed the success to the *Rappahannock*, after expressing regret at the absence of Mr. Furness, M.P., the Chairman of the company, whose parliamentary duties prevented him from leaving London, and also the absence of American friends, Mr. Murray and Mr. Walker. He said there might be other steamers both larger and faster, but he was confident the *Rappahannock* would be second to none crossing the Atlantic for the purpose she was intended for. He thought the owners might congratulate themselves on having secured in this and the other new ships of the line, vessels that would be satisfactory to them. It was the greatest pleasure to deal with gentlemen like the directors and others connected with this enterprise. They thoroughly knew the requirements of their trade and as a result he was sure they would be successful This was the three hundred and forty-fourth time he had had to wish prosperity to a ship built by his firm, which perhaps no other man now living could say; and he had the greatest pleasure in associating with this toast the name of Mr. Glynn, who was well qualified to judge a ship when he saw her. Mr. Glynn said he had great pleasure in replying. Speaking of the ship, he said the great consideration, especially in such times as these, was that of L. S. D., and even with the bad times he was confident in this respect. Many people thought that anyone could take to shipowning, and that the help of a naval architect and a clever engineer was all that was needed to secure success; but here as elsewhere it was found that success required a special training, and a man must learn thoroughly whatever he has to do. The *Rappahannock* was in his opinion as handsome and suitable a vessel as ever he saw. He spoke in high terms of the builders' good and thorough work, and of the pleasant way in which their business was conducted. He wished them much success for other four hundred launches. Before concluding he would propose the health of Mrs. Mackenzie. He was sure everybody had been pleased with the launch, and he had never seen the ceremony of naming a ship more becomingly and gracefully performed. Mrs. Mackenzie in a few graceful words acknowledged the compliment, remarking that as it was her first launch, it was also her first speech. Mr. Mackenzie in felicitous terms proposed success to the firm of Alex. Stephen & Sons, expressing the hope that their success in the future will be as marked as in the past. Mr. F. J. Stephen replied. In thanking Mr. Mackenzie and the company on behalf of the firm, he said he had been glad to hear Mr. Glynn's opinion of the *Rappahannock*. In her construction the owners and the builders had consulted together a good deal in the desire to obtain the best ship for the trade intended; and he was sure that both the owners and the builders would have reason to be satisfied with the result.

LAUNCHES—IRISH.

Magellan.—On August 3rd shortly after one o'clock, the new steel screw steamer *Magellan* was successfully launched by Messrs. Harland & Wolff from the north-east end of the Queen's Island. The vessel has been built for the Pacific Steam Navigation Co., and is intended for their cargo service between Liverpool and the west coast ports of South America. Her gross tonnage is 3,580. She will have two masts, be schooner rigged, and will be provided with steam windlass; also with steam winches and every facility for the rapid handling of cargo, and will be fitted with an electric light installation. The triple-expansion engines for the *Magellan*, which have an I.H.P. of 1,900, have also been constructed by the builders. The propeller will be of manganese bronze. It may be mentioned that this is the fifth steamer launched by Messrs. Harland & Wolff within the past eight months for the Pacific Steam Navigation Co. Mr. Hugh Brown was present at the launch on behalf of the owners.

Ormidale.—On Thursday, August 17th, at high water

Messrs. Workman, Clarke & Co., Limited, launched from their shipbuilding yard, Spencer basin, Belfast, a large steel screw steamer built to the order of Messrs. R. & C. Allan, of Glasgow. The principal dimensions of the vessel are—Length, 361 ft.; breadth, 44 ft. 3 in.; depth, 29 ft. moulded, with a gross tonnage of 3,550. She is built to Lloyd's 100 A1 class and is of the three-deck type, with poop, bridge, and topgallant forecastle, decks and cellular double bottom fore and aft for water ballast. The upper and main decks are of steel and in addition the upper deck is sheathed with teak. The hold beams have been dispensed with leaving the holds unobstructed for stowage of cargo. For the working of cargo a complete arrangement of winches and derricks has been arranged having two at the larger hatches fitted with patent direct steam capstan windlass, by Emerson Walker & Co. The bridge contains the saloon and accommodation for the captain and officers, the saloon being panelled in oak and upholstered with Utretcht velvet. The crew are housed in sidehouses under the forecastle deck. When completed the vessel will be rigged as a brigantine with lower topsail and topgallant yards on fore mast. A complete system of electric lighting is introduced into the rooms, holds and machinery spaces, fitted up by W. C. Martin & Co., Glasgow. The machinery has been constructed at Messrs. Workman, Clarke & Co's. engine works, and consists of triple-expansion engines and two large steel boilers, with a working pressure of 180 lbs., and fitted with James Howden & Co's. system of forced draught.

LAUNCHES.—American.

Thomas Cranage.—On July 29th there was launched from the yard of Captain James Davidson, at West Bay City, Mich., U.S.A., the wooden steamer *Thomas Cranage.* The vessel, which is 321 ft. long, is said to be the largest wooden steamer on the Great Lakes.

Emeline.—There was recently launched from the yard of the Delaware River Iron Shipbuilding and Engine Works, at Chester, Pa., U.S.A., the steam yacht *Emeline*, built for Mr. John B. Roach, president of the company. The vessel is 108 ft. long, 16 ft. 6 in. beam, and 6 ft. 8½ in. deep. Motive power is supplied by a set of triple-expansion engines, having cylinders 9½ in., 14 in., and 24 in. diameter, by 14 in. stroke.

Three-masted Schooner.—There was recently launched, at the yard of Mr. J. Saverhoff, Sharptown, Ind., U.S.A., a three-masted schooner. The vessel is 125 ft. long, 24 ft. beam, and 6 ft. 8 in. deep.

LAUNCHES—German.

Nordstrand.—On July 19th there was launched from the yard of the Neptune Shipbuilding Co., Rostock, Germany, the steel cargo steamer *Nordstrand*, of 1,200 tons, built for Messrs. Lange Brothers, Hamburg.

Antonina.—On July 29th Messrs. Blohm & Voss launched from their yard at Hamburg the steamer *Antonina*, of 3,000 tons, built for the Hamburg and South American Steam Navigation Co.

Modestia.—On August 10th a very fine modelled steamer was launched by the Flensburg Shipbuilding Co. She has been built for the Hamburg Pacific Line, and has the dimensions:—336 ft., by 42 ft., by 28 ft., and will carry about 4,300 tons. In starting on the ways she was christened with the name *Modestia* by Miss Lizie Kirsten, youngest daughter of Mr. A. Kirsten. After the launch the vessel was placed under the new 100 tons sheerlegs, belonging to the Flensburg Shipbuilding Co.

TRIAL TRIPS.

Nernia.—On July 21st the s.s. *Nernia*, built by the Elsinore Shipbuilding and Engineering Co., Elsinore, Denmark, was taken on her trial. The vessel, which has been built to the order of Mr. F. Lauritzen, of Esbjerg, was launched on June 28th. Her dimensions are:—Length, 188 ft.; breadth, 30 ft.; depth, 13 ft., and her carrying capacity about 950 tons deadweight. The machinery consists of a compound engine having cylinders 22 in. and 42 in. in diameter by 27 in. stroke.

Erivan.—On July 31st the screw steamer *Erivan*, recently launched from the Howdon yard of Palmer's Shipbuilding and Iron Co., Limited, was taken to sea on her trial trip. This vessel is 285 ft. long, 38 ft. 6 in. broad, and 27 ft. deep, her gross displacement when loaded being nearly 5,000 tons. The *Erivan* has been specially built for the oil carrying trade to the order of the Société Anonyme de Transports en Vrac of Antwerp. The vessel's hold is divided into seven large tanks in front of the engine and boilers, a strong longitudinal bulkhead being carried amidships right fore and aft, and is provided with properly constructed coffer-dams. She is also provided with two sets of Clarke Dowson's 7-in. pipe pumps, which are capable of discharging her full cargo of 3,250 tons of oil in little over eight hours. Electric light has been fitted all throughout the ship. The engines, also made by the Palmer Co., have cylinders 22½ in., 36½ in., and 60 in. in diameter, with 42 in. stroke. During the trial, which lasted 11 hours, they worked with the greatest smoothness and steadiness, and propelled the vessel at 10·6 knots an hour, being considerably over contract speed.

Pro Patria.—The s.s. *Pro Patria*, which has been built by Messrs. John Scott & Co., Kinghorn, was launched on July 31st, with steam up, and went for her speed trial on August 2nd, in the Firth of Forth. The vessel, which is of the awning-deck type, is 185 by 28 by 20. On a four hours' continuous trial the speed was found to be over 13 knots, and on the measured mile 13¾ knots per hour. The engines during the whole of the trial worked without a hitch, and gave every satisfaction. She has accommodation for a large number of passengers, and has been built to the order of Mr. Theo. Clement, of St. Pierre, for his mail and passenger trade in Newfoundland.

James Tennant.—On August 5th the new steel screw steamer *James Tennant*, built by Messrs. Wood, Skinner & Co., Bill Quay, for Messrs. T. Thompson & Son, Newcastle, was taken to sea on her trial trip. The vessel is intended for the coasting trade, and has all the latest improvements fitted to vessels of her class. The machinery was constructed by the North-Eastern Marine Engineering Co., Limited, Wallsend, and during the trial the engines worked exceedingly smoothly and well, and without the slightest hitch. There was a strong wind and considerable sea, but the vessel, though in light trim, behaved well, and gave the utmost satisfaction to all on board. Both ship and machinery have been built under Lloyd's special survey for 100 A1 classification, and have been superintended for the owners by Mr. C. H. Smith, Newcastle. After the trial the vessel was taken into Tyne Dock to load coal for her first voyage. Captain Henderson will take command.

Marie Henriette.—On August 5th a fine new paddle-steamer was added to the now popular mail service between Dover and Ostend. The last new addition, the *Marie Henriette*, built by the firm of Cockerill & Co., at Antwerp and Seraing, Belgium, underwent her official trials on the Clyde, and realised a mean speed during a continuous trial of four runs, between the Cloch and the Cumbrae Lights, of 22·2 knots per hour (the distance between the lights being 13·666 knots). The speed guaranteed by the builders was 21½ knots, with a heavy premium in their favour for extra speed, which they have secured to the extent of £4,000. The speed of the sister ship, the *Leopold II.*, built in England, and tried at the same place, between the Cloch and the Cumbrae, was 21·955 knots; the *Marie Henriette* has, therefore, notwithstanding the unfavourable weather, surpassed this by one quarter of a knot. The trial took place in the presence of the Belgian Government Commission, by which all the results were verified. The engines gave an I.H.P. of 8,200, with a pressure of 120 lbs. of steam and 53 revolutions.

Volute.—On August 5th this ship was tried at sea, when a very satisfactory run was made on the measured mile, and a speed of ten knots was attained, the vessel having on board at the time 800 tons bunkers No. 3, 4, and 5 oil tanks, and the whole of the ballast tanks full of water. She is the fifth vessel built by Messrs. Wm. Gray & Co., of West Hartlepool, for Messrs. M. Samuel & Co., of London, and like the others has been built under the superintendence and from the specifications and plans of Messrs. Flannery, Baggallay & Johnson, of London and Liverpool. Her length is 347 ft.; breadth, 45 ft. 6 in.; and depth of hold, 28 ft. 6 in.: and is driven by engines having cylinders 26 in., 42½ in., and 70 in. diameter, with a stroke of 45 in., and taking steam from three single-ended boilers 14 ft. 1 in. diameter and 10 ft. long. She is constructed like the previous vessels for the carriage of petroleum in bulk to the East and return genera cargo.

Magic.—On August 10th the new twin-screw steamer *Magic*

built by Messrs. Harland & Wolff, Belfast, for the Belfast and Liverpool service, went on her trial trip. The directors of the Belfast Steamship Co., their principal officers, and the builders were on board. The *Magic* is 310 ft. long, 38 ft. beam, and 17 ft. 9 in. deep.

Suchet.—On Thursday, August 10th, the cruiser *Suchet* was launched at Toulon. She was originally designed as a sister to the *Davout*, but was subsequently lengthened. As built, she measures 318 ft. 3 in. long by 43 ft. 5 in. broad, and, at a mean draught of 21 ft. displaces 3,430 tons. She contains two horizontal compound engines, together developing with natural draught 5,000, and with forced draught 9,000 H.P. Her extreme speed will be 20 knots. The armament is to consist of four 6·2 breechloading, four 3·9 quick-firing, twelve 1·8 and 1·4 quick-firing, and six 1·4 Hotchkiss guns, with six torpedo ejectors. She was launched with her machinery on board, and she will be ready for trial in November.

Pelotas.—On August 11th the *Pelotas* (s.), which has been built to the order of the Hamburg South-American Steamship Co., of Hamburg, was taken to sea for trial, when satisfactory results were obtained from the machinery, an average speed of 10 knots per hour being attained after several runs on the measured mile under easy steaming. The hull has been constructed by Messrs. Edwards's Shipbuilding Co., Howden-on-Tyne, and is of the spar deck type, is classed at Bureau Veritas and fitted with all the most modern and effective appliances for working cargo. The principal dimensions of the vessel are.—Length, 280 ft.; breadth, 38 ft.; depth, moulded spar deck, 26 ft. The engines, from the works of Messrs. George Clark, Limited, Sunderland, are on the triple-expansion system, and have cylinders 21 in., 34 in., and 56 in., with a stroke of 39 in.

Kalman Kiraly.—On August 12th the steamship *Kalman Király*, a fine steel screw steamer built by Messrs. Wigham Richardson & Co., at the Neptune Works, Newcastle, went for a trial trip off the Tyne. This vessel has been built to the order of the Royal Hungarian Sea Navigation Co., Adria, Limited, of Fiume and Budapest, and is 285 ft. in length, by 28 ft. beam. She is fitted with triple-expansion engines, which, with the boilers, have been constructed by Messrs. Wigham Richardson & Co. During the trial the machinery worked without a hitch, driving the vessel at a good speed, and giving satisfaction to all present, including Mr. Hoor, the representative of the Hungarian Government, and Mr. Alex. Rolland, the representative of the owners.

Marie.—On August 12th the *Marie*, built by Messrs. Wm. Dobson & Co., Low Walker, to the order of the Russian Co. for the conveyance of goods to Odessa, went for her official trial off the mouth of the Tyne. The steamer is intended for passengers and cargo, and everything which could add to the comfort of the passengers has been introduced. The trial was in every way satisfactory, the working of the machinery being all that could be desired. On the completion of the trial the *Marie* left for Odessa, in command of Captain A. Emeretly, under whose personal supervision the vessel has been constructed.

Steam Hopper Barge.—On August 18th the steam hopper barge "No. 22," recently constructed by Messrs. Wm. Simons & Co., Renfrew, for the Clyde Trustees, underwent its speed trials with most satisfactory results. The mean speed obtained on two runs between the Cloch and Cumbrae Lights (a total distance of 27½ knots) was fully 11 knots. This speed was made with a load of 1,220 tons of dredgings on board, and is considerably in excess of the contract.

Olive.—On August 24th this steamer was taken out on trial at the measured mile at Tynemouth, when a speed of 9¾ knots was obtained, the vessel being loaded. The trial was in every way satisfactory. The *Olive* has been built by Messrs. W. Harkess & Son, of Middlesbro', for Messrs. J. Burnett & Sons, of London, for their London and Paris line, and she is fitted with lowering masts and funnel to enable her to pass under bridges across the Seine. The dimensions are—173 ft. by 26 ft. 6 in. by 12 ft. 9 in. The engines are by Messrs. Westgarth, English & Co., of Middlesbro', and have cylinders 15½ in., 25 in., and 41 in. by 27 in.

Rappahannock.—On Thursday, August 24th, the above vessel, recently aunched from the shipbuilding yard of Messrs. Alex. Stephen & Sons, Linthouse, went down the river on her trial trip. The *Rappahannock* is the first of three vessels ordered from Messrs. Stephen & Sons by the Chesapeake and Ohio Steamship Co., of Newport News, U.S.A., for their cattle transport trade between that port and Liverpool. The dimensions of the vessel are as follows:—Length between perpendiculars, 370 ft.; breadth, 44 ft.; depth, 31½ ft., with a dead weight carrying capacity of between 5,000 and 6,000 tons. A full description of the vessel is given in our launch columns. The machinery is of the triple-expansion type, with all the latest improvements. The cylinders are 28 in., 46 in., 75 in. diameter respectively, and stroke 54 in., and are supplied with steam by two large double-ended steel boilers working at 160 lbs. pressure. The engine-room is replete with all the most modern appliances for the saving of fuel and for economical working, such as Weir's pumps and feed heater, Morison's evaporator and pump, Drysdale's centrifugal circulating pump, large ballast pump, and other auxiliary pumps. There is also a separate pump in the engine-room solely for the purpose of pumping fresh water for watering the cattle, while the powerful ballast pump is connected to the various decks by iron pipes for washing and fire purposes. There is a large donkey boiler of the same type as the main boilers for working the winches and windlass, which are of powerful construction. On reaching Skelmorlie the vessel was put on the measured mile to test her speed, and notwithstanding that her condition of trim was not particularly favourable for high speed making, she attained an average speed of about 14 knots, the engines working with the utmost smoothness and regularity. After the trial runs were over the company adjourned to the saloon to partake of dinner. The chair was taken by Mr. A. E. Stephen, and among the company were Captain Maulay, ship's husband; and Mr. Geo. MacFarlane, superintendent engineer of the company; Mr. Mollison, Lloyd's chief engineer surveyor; Mr. James Weir, of Cathcart; Mr. Barr, of the B. I. S. V. Co.; Captain Penwill (who is to command the steamer), Mr. Fred. J. Stephen, Mr. B. Stephen, Mr. Wm. Wylie, &c. The usual toasts, &c., were proposed and responded to, and after the company had dispersed the vessel proceeded down the Firth on her way to Newport News, U.S.A., to take on board her first cargo.

Dart.—The new steam trawler *Dart*, built for Messrs. Morris & Jeffs, jun., Grimsby, by Earle's Co., has just undergone her trial outside Spurn. She is the third out of a batch of four ships ordered at one time, and is intended for North Sea fishing, for which she has been equipped by the builders with all the most recent and improved appliances. Besides the owners, there was on board a large party of experts from Grimsby and elsewhere to watch the trial, the results of which proved highly successful, both as regards the handiness of the ship, the behaviour of her engines, and the speed, which was recorded at over 11 knots by the patent log. On her return the vessel was berthed in dock at Grimsby preparatory to her going on her maiden fishing trip.

Etruria.—The new Italian cruiser *Etruria*, built by Messrs. Orlando Bros., Leghorn, has recently successfully completed her trials. The vessel, which is 263 ft. long, 39 ft. 6 in. beam, and 15 ft. deep, has been built to the designs of Commander Masdea. At the trial, which extended over a period of six hours, an average speed of 18 knots was attained, the engines indicating 4,300 H.P., being 300 H.P. more than that stipulated for in the contract.

Rhone.—A most successful run has been made by the *Rhone*, the latest addition to the Grimsby fleet of steam trawlers. She has been built to the order of Mr. G. F. Sleight, of Grimsby, and is sister ship to the steamer *Rhine*, and the second of three vessels for that gentleman. The hull has been constructed at Messrs. Cochrane & Cooper's yard, at Beverley, and Messrs. Charles D. Holmes & Co. have carried out the contract, and fitted the vessel with her engines and machinery, which are of the latest type. The trial was most satisfactory, the behaviour of the vessel and the working of the machinery being all that could be desired.

United States Warships.—Three new United States warships have lately undergone their trials. The monitor *Monterey* did 12·75 knots; the training vessel *Bancroft* did 14·4, or 2·4 more than had been anticipated; and the gun vessel *Machias* did 15·46, or ·46 more than the stipulated speed.

Yoskino.—The cruiser *Yoskino*, built by Sir W. G. Armstrong, Mitchell & Co., Newcastle-on-Tyne, for the Japanese Government, was recently taken for her trial trip. The vessel is 350 ft. long, 46 ft. 6 in. beam, with a displacement of about 4,000 tons. The armament of the vessel comprises four 6-in. quick-firing guns, eight 4·7-in. quick-firing guns, twenty-two

3-pounder quick-firing guns, and five torpedo tubes. Four runs on the measured mile, with and against the tide, in accordance with the practice of the British Navy, were made under forced draught, when the actual speeds recorded were:—First run, against the tide, 22·642 knots; second run, with the tide, 23·377 knots; third run, against the tide, 22,571 knots; fourth run, with the tide, 23·762 knots, the average speed being 23·03 knots. The engines, which have been constructed by Messrs. Humphreys, Tennant & Co., Deptford, worked throughout the trial without hitch of any kind.

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The Dynamo, its theory, design, manufacture. By C. C. Hawkins, M.A., and F. Wallis, A.I.E.E. London: Whittaker & Co. 1893.

Electric Light Installations, vol I. The management of accumulators. By Sir David Salomans, Bart., M.A. London: Whittaker & Co. 1893.

These two volumes form part of the well-known "Specialist series," which contains so many useful works on the practical aspect of scientific subjects. The authors of the first-named volume (which is new) aim at affording the student a simple account of the modern dynamo, and thus combine the practical and scientific aspects, whilst they try also to make the book interesting to that much catered for person the "general reader." How far they succeed in their aim in the last-named part of the undertaking depends, to a large extent, upon what is to be understood by the expression "general reader," especially when qualified by the adjective "scientific." The ordinary reader would, we fear, be entirely bewildered by any of the scientific terms that of necessity are used in speaking of so elaborate and technical a subject. Yet, on the other hand, scientific education is becoming so much more general nowadays that we need not fear to speak of topics which a few years ago would have been unintelligible save to a limited class of experts. Having touched on this aspect of the book we may glance at it from the student's point of view, and in doing so we have nothing but praise to accord to the authors. The plan of the work is excellently conceived and is elaborated in an attractive and workmanlike manner. The style, always an important matter and in our judgment one to which too little attention is often paid in scientific works, is exceedingly plain and pleasant, and the book undoubtedly fulfils the claim of its authors as being a new treatment of this important subject. Beginning with an explanation of the dual nature of the dynamo from its electrical and magnetic characteristics, they pass through a discussion of the theories involved to explanations of the construction and working of the various types in use. We feel assured that the book will prove a valuable addition to the series.

Sir David Salomons' book is one which has already, though in a less ample form, and under another name, passed through no less than six previous editions, and is doubtless known to many of our readers under its old description, "Electric Light Installations and the Management of Accumulators." This volume is of course an amplification of the later part of the old subject. The headings of the chapters will tell us the practical nature of the book. Chapters on the description of cells, on the setting of them up, on charging and discharging, and finally on failures and their remedies, seem to embrace all the points that need elucidation. Moreover the author gives practical hints on points that if a little outside the strict text on which he writes may nevertheless affect very seriously the success of an installation. For instance, at page 88, speaking of the accumulator house at Broomhill, he tells how by the aspect and arrangement of the building the direct sunlight is prevented from ever falling on the glass cells and so an important and apparently mysterious cause of breakage is avoided, whilst at the south end of the building, where a window has to be put, the difficulty is got over by planting shrubs to obstruct the rays. The lighting tables furnished by Mr. Crompton for the different months of the year will be found both interesting and useful.

Warships of the World. 1893. Published by Lloyd's Register, London.

Once more we have to notice this work, which enables us to see the relative strengths of the navies of the world. In regarding the tables we must bear in mind that there are many vessels included, as for instance the British battleships *Magnificent* and *Majestic* and the fleet of 27 knot torpedo catchers, which are as yet little more than good intentions. The list of warships shows us what is the task before the Navy in time of war and who are our possible opponents, whilst the tables of statistics from Lloyd's Register book give some idea of the magnitude of the mercantile marine which has to be protected. The usual tables of fast merchant vessels is also given, to show the supply of armed cruisers, despatch-boats, and steam colliers that can be made available in the day of need. These latter tables are shown first with the vessels arranged as to speed and again as to ownership. And herein we notice that the accurate compilers have made some slight errors. Thus the West India Royal Mail steamer *Magdalena* seems too highly placed in the 18 knot class, when the famous *Scot* is put at only 17½. Indeed several of the vessels of the West India fleet are credited with a speed they never reach at sea. In the table of owners the new Cunarders appear as 21 knot boats—the *Campania* has already done twenty-two continuously at sea. In respect to her and other recent fliers it may be remarked that the class that contains vessels of 19 knots and over must soon be divided to show those of greater speed and a class made for those over 20 knots. Where, however, all is so correct, it seems hyper-criticism to point out such slight matters. Now that so many old-type battleships are being re-engined and made more up to date in speed and armament it might be an assistance to the general reader if the fact of having had new engines and the date of the alteration were notified, as it is in the register of merchant shipping. It would then be apparent that in economy of fuel at least the vessels so distinguished had been improved.

A handbook to the Steam Engine, with special reference to small and medium-sized engines. By Herman Haeder. London: Crosby Lockwood & Co. 1893.

The present volume is, as the title page tells us, written by a German civil engineer, and the work has already reached a second edition in its native country. It has been translated from the German by Mr. H. H. P. Powles, who has made considerable additions and alterations to make it suitable to the requirements of English readers. Mr. Powles has acquitted himself of his task well. There is little trace of translation in the text, and his alterations have made the English edition even more valuable than the German original, because he has added matter relating to the practice of engineers in this country, and thus enabled valuable comparisons to be made between our own and foreign practice in matters of construction.

The translator's office must have been no sinecure, for the book teems with figures and tables of dimensions, and everywhere the measurements are given in British feet and inches. It will be observed that a very large number of valve arrangements are described and illustrated, and some of these may be new to our readers. Nearly every form of engine in modern use is described and illustrated, and the dimensions and weight of the various parts in several sizes given. An interesting table is given at page 313. It gives the cost of patterns, complete with coreboxes, for engines with Rider's valve gear. The values are given in marks, but these are very easily taken as British shillings, though, of course, when great accuracy is required, we must, as told in a footnote, take the equivalent as 11¾d. From such a table the practical man may gather some idea as to the comparative cost of such work in British and German shops. Some attention is given to boilers. The ordinary marine types, the Lancashire, the Cornish, the German Cornish, and the Babcock and Wilcox are all noticed. The book as a whole is an important addition to the large scientific library issued by the publishers.

The Atlantic Ferry. By Arthur J. Magginnis. London: Whittaker & Co. 1893. Popular edition. Price 2s. 6d.

We have already treated Mr. Magginnis's work at some considerable length. The present issue gives the information contained in the first edition in a popular form and at a popular price. The volume has, we are told, been brought down to date so as to include the recent performances of the *Campania*, which have excited so much interest, and certain chapters which contained information not "of a sufficiently interesting character to warrant their insertion in a popular issue," have been omitted.

We explained in our original notice that the character of the work was essentially popular, and it is hard to believe that anything in the very readable first edition was of too deep and scientific a nature to be acceptable to the general reader.

In the tables from pp. 8 to 11, we are glad to see that the author has accepted the corrections of his critics. But if the

book is to contain the "recent performances of the *Campania*," these tables should refer to her steaming performances, and not leave the best day's steaming record with the *City of Paris*, whilst the *Campania* is debited with the maximum day's consumption. As we are told at page 60 of the sale of the Guion liner *Wisconsin* in May of the present year, we know that the record we refer to must have been made before the book went to press. At page 73 we come across a very evident printer's error. Quoting from the *Journal of Commerce*, on the subject of the remarkable performance of the s.s. *Britannic*, it quotes the date as 1880, instead of 1890. In other respects we now consider the book fairly accurate, and no doubt the increasing interest in the performance of the vessels which run on the Atlantic Ferry, and the rapidity with which history is now made by the constant succession of greyhounds—each faster and larger, more luxurious and more costly, with a greater consumption of coal and a larger engine-room staff than any of her predecessors, will soon demand a third edition of the book. When the new chapters are added and the volume again comes up for review, may we read it with as much interest as we did the present, and may we find the complicated details and statistics as accurately stated and as attractively put as we see them to-day.

The Gas, Water, and Electric Lighting Companies' Directory. 1893. London: Hazell, Watson & Viney, Limited. Price 10s. THE mass of interesting and valuable information contained in the seventeenth issue of this useful work is absolutely surprising. In addition to the directory proper, which contains particulars of the various companies at home and abroad (giving gas, water, and electricity under separate heads, and subdividing these into those of England and elsewhere), we find a general index of names from which it is easy to learn the concern with which any one devoted to the profession is at present associated.

But to us the most interesting parts of the volume are the summaries of the leading events of the year, and the statistical tables. The former contains an account of the progress recently made towards the commercial production of water and oil gas. Like many things which have eventually come to be distinct benefits to our civilization, water-gas has made an unfortunate beginning in the eyes of the public, not owing to the character of the invention itself or to the scientific men concerned, but simply because of the financial matters connected with the raising of capital to work some of its developments. Other inventions have survived a similar experience, and we may yet see these performing a useful part in our every-day life. An interesting note on big gas holders recently constructed will attract our readers' attention. At Bristol the year has seen the building of one of 222 ft. diameter, and five and a half million cubic feet capacity. But this is altogether eclipsed by that of the South Metropolitan Gas Works at East Greenwich, whose capacity is no less than twelve millions.

There are several estimates quoted as to the comparative expense of electric and gas lighting. These vary very considerably, and it is not altogether surprising that they should. The circumstances of every installation vary in some material point from those of every other, and that being so the expense of erection and working must vary likewise. It certainly is a curious matter, though an undoubted fact, that whilst electric lighting is being introduced the demand for gas—at all events in many places—is increasing at the same time. The explanation afforded is that the demand for illumination is increasing. This is true, but a further explanation may be found in the increasing use of gas stoves for cooking purposes, a demand that will continue to increase as the methods of constructing the stoves are improved.

The tables of statistics are most instructive. We have no space to analyse them, but it is obvious that both as regards gas and water the number of customers served and the local situation of the works have more to do with the economy of working than the most skilful management. To sum up it is apparent from what we have said that the volume contains much to interest scientific persons outside the large circle of those directly interested in these important industries.

Vertical Milling Machine.—An order for a large vertical milling machine, costing over £1,000, has been placed with William Muir & Co., Manchester, by Sir William Gray & Co. Limited, Central Marine Engine Works, West Hartlepool. The machine is capable of dealing with the heaviest of marine and general engine forgings, and will mill round a 4 ft. 6 in. throw crank of the marine type at one setting.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—ED. M. E.]

THE "GREAT EASTERN."

To the Editor of THE MARINE ENGINEER.

SIR,—Dr. Elgar's paper, read at the meeting of the Institute of Naval Architects' Union, on a "Comparison of the *Campania* and the *Great Eastern*," contains one very curious statement. You quote it without comment in your Editorial, and I think the other scientific papers have shared your dread of exposing the mistake into which so great an authority has fallen. What I would call attention to is the statement that the building of the *Great Eastern* at the time she was built was like the construction now of a vessel of 1,200 ft. in length and of 30 to 35 knots speed. You logically deduce from this statement that Dr. Elgar means to assert that the *Great Eastern* accomplished an increase of speed of 50 per cent. over her predecessors. In this statement he is entirely wrong, though owing to the length of time which elapsed between her conception and her completion, I may take some little space in proving my point.

I think no one will say that her plan was elaborated before the year 1853. At all events her keel was not laid till the summer of 1854, and her launch was not attempted till November, 1857. The celebrated trial trip on which she attained a speed never afterwards approached by her, took place in September, 1859. As the trial was the best measure of her speed, I should sufficiently prove my point if, admitting that she did 15 knots on that occasion, I could show that in that month there were 10-knot steamers in existence. I, however, will try to prove more. Previous to her first Atlantic voyage she made no less than four trial trips. I find that the best performance on any of these was 13½ knots under steam. Being put under sail as well the speed was increased to nearly 15 knots. This is hardly a legitimate way of making her a 15 knot steamer, but I will let that pass. We must now see what proof we can bring forward that 10 knots was at this date something under the maximum known. If we could get a few months later we could bring in the four celebrated vessels of the City of Dublin Steam Packet Co. which are to-day carrying Her Majesty's mails between Holyhead and Dublin. Their speed on trial (without sail) was a slight fraction under 18 knots. But these are outside the limit of time. I will therefore take the *Persia*, of the Cunard line, which at the beginning of 1856—22 months before the launch of the *Great Eastern* was attempted—did 16 knots at sea, and maintained that average for some ten hours. This is not only not 33 per cent. worse, but is actually considerably better than anything the monster ever did. Nor was the *Persia* alone in this speed. P. & O. had some fast vessels at this time, and some of the West India mail boats did good speeds on the measured mile. It will be said that the measured mile speed in the case of these latter was never afterwards reached. That may be, but it is equally true that the *Great Eastern's* so-called 15 knots was quite a unique incident in her career.

Finally it may be said that the performance of the *Great Eastern* must be considered as of 1853, when she was designed, rather than of later years. Even then Dr. Elgar's contention is incapable of support, for the original Collin's boats, at work in 1850, did 13·4 knots *at sea*, and the Cunarders of that date were worthy opponents.

Space does not allow me to give dates and authorities for my statements, but I make none which are not supported by contemporary records in my possession which are at your (or Dr. Elgar's) disposal.

Before closing I may add that her low speed and power were considered, even in her early days, a weak point in her design, and that on that account she was considered unfit for the Atlantic trade. In fact, certain shareholders sued the directors for neglect of duty in ever putting her on the route against "fast steamers."

Yours faithfully,

B. W. GINSBURG, M.A.

12, King's Bench Walk, E.C.,
18th August, 1893.

Miscellaneous.

Stone's Bronzes.—We have received the catalogue of these well-known alloys, which are obtainable of Messrs. Stone and Co., of Deptford, S.E. The alloys are of four principal sorts, according to the purpose for which they may be required, the first for bearings, the second for slide valves, the third for propeller blades, and other marine castings, whilst a sub-division of this is prepared for moderate and especially tough castings. The fourth is suitable for forgings. They also make a speciality of white bronze for lining-up bearings, and this is in two varieties, for the "Navy," and for "locomotive" purposes. The advantages of these materials are shown by the fact that already upwards of two hundred vessels have been fitted with propeller blades, to the satisfaction of the owners, and the manufacturers show their faith in their produce by guaranteeing their blades against fracture for twelve months, on certain reasonable conditions. The toughness of the No. 3 quality is very remarkable. In a paper read to the Institute of Naval Architects in 1888, it was stated that its strength was fully equal to that of steel, is more than double that of gun-metal, and is much in excess of that of other alloys sold for the same purposes. Its durability is, of course, greatly in excess of that of steel, and thus by its use it is contended it is possible to have a lighter and more theoretically perfect blade, than can be obtained by the use of any other material. These contentions are supported by letters from numerous customers, detailing their satisfactory experiences, and by a very considerable body of expert evidence, the result of careful tests made as regards strength under various kinds of strains. Some of these results are embodied in diagrams. The work also contains a list of some of the principal firms using the bronzes, and it appears that this includes many of the principal shipowners, shipbuilders, and engineering firms in the country, as well as large foreign customers. The book is well bound, and contains many illustrations.

Engines for the Renown.—Messrs. Maudslay, of London, have secured the contract for the construction of the engines for the new battleship *Renown*, for which several Clyde firms were invited to tender. The engines are of the triple-expansion type, and will drive twin screws. They are to indicate 10,000 H.P. under natural draught conditions, giving the vessel a speed of 17 knots. Should it be thought desirable to subject the boilers to forced draught, a point not yet determined, it is expected that 12,000 I.H.P. will be developed. I believe some of the Government engineering managers were anxious that these engines should be constructed in the dockyard; but the Board while very willing to give out smaller engines to the Government establishments, are indisposed to go further until the results of some of the larger engines now being built are determined. The *Renown*, I may mention, has all the characteristics of the *Ramillies* class, the length being 380 ft., beam 72 ft., and displacement 12,350 tons. She is to have four 10-inch breechloading guns, in addition to the usual battery of quick firing weapons. These latter are to be protected by an upper belting of auxiliary armament, as in the *Ramillies*. This last-named Clyde battleship will soon join the Channel Squadron, *vice* the *Anson*, and it is understood that Commander Jellicoe, formerly of the *Victoria*, will be appointed to the command.

New Harbour at Beyrout.—The Secretary of Lloyd's has received from the Agents at Beyrout a report on the progress of the new harbour at that place. The concession was given to a French company for a term of 60 years, and the works were begun in 1889. These are a harbour, quays, warehouses, and horse tramway, the quay to extend 1,200 metres. The revenue is to be derived from dues on vessels and goods imported and exported. The works are well advanced, but it will probably take two more years to finish them. The long jetty is already constructed about half way, and there is room for several steamers to come within the protection of the harbour. Ships anchor within the harbour, but do not come alongside, as there is no depth of water, and goods are discharged into lighters of four or five tons capacity. The large steamers of the Messageries Maritimes and other companies do not venture inside the harbour, but anchor outside. Although the harbour is yet so far from completion, the Ottoman Government has now permitted the company to commence levying the dues. These dues were considered very heavy, and the Agents mention that the port company were trying also to get the monopoly of handling the goods, but this was being opposed by the merchants. The charges on merchandise would be heavy enough to drive the trade to other ports, for previously no dues of any sort had been paid by ship or goods.

The Lucania.—The arrangements of the builders and owners of the new Cunarder have been somewhat upset by a slight accident which has occurred on the big ship. She went down the Clyde on the last day of July, and in her passage down stream encountered some hard substance, which, whilst it did not break any of her plates, indented several of them. The intention was that she should undergo her preliminary trials at the mouth of the Clyde, then go to Liverpool to be docked, scraped, and painted, and return to the Tail of the Bank for the full speed and sea trials. The first part of this programme was carried out, and when she was docked the damage became apparent. The question arose as to whether she should carry out the original arrangements and leave the plates till her December overhaul, as might very safely have been done. But the motto of the Cunard Co. has never been to send a ship to sea if there was a screw loose anywhere, and so the old tradition prevailed, and the work was undertaken forthwith. She is appointed to sail on September 2nd, and as she comes out of dock on the Saturday previous, there will be ample time to get ready for it, but the cruise round Ireland will have to be foregone.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from July 13th to August 17th, 1893.

13572 A. J. Boult. (E. Boulet. France.) Making tubes.
13581 H. Booth. Improved governors of engines.
13583 J. Gordon & C. R. G. Smythe. Metallic cylinders.
13591 E. Howl & S. Warburton. Metallic packing.
13637 F. R. Simms. (R. Holtz, Germany.) Reversing screw-propellers.
13675 J. D. O'Brien. Hatches for spar deck steamers.
13711 J. F. Green. Steam hydraulic lifeboat.
13767 D. Appleton. Means for lubricating bearings.
13805 W. J. Thomas. Paddle wheels for ships.
13810 R. F. Mack. Preventing the foundering of ships.
13811 L. Price. Marine brake.
13825 R. Shaw. Fastening the lid of vessels.
13830 W. H. Price. Diving apparatus.
13847 R. C. Hadfield. Making maganese steel.
13869 T. Vernon. Propelling ships or vessels.
13878 W. Holland. Manufacture of tubes.
13886 H. W. Boswell. Appliance for steering ships.
13939 J. Y. Johnson. (P. Dubiau, France.) Steam generators.
13947 W. T. Howard. Measurement of steam pressure.
13954 A. Currie. Water-tight hatch for vessels.
13977 R. Meyer. Packing for steam cylinders, &c.
13999 S. H. Cantrowitsch. Fenders for ships, &c.
14020 L. Radmore. Closing water-tight compartments.
14021 H. Foster. Tubular fire brass for furnaces.
14022 J. Harrison. Adjustable wrenches, &c.
14046 H. Read. Reversing gear for engine valves.
14052 E. E. Doddrell. (G. Doddrell, Portugal.) Pipe wrenches.
14059 A. Collman. Valve gear.
14066 J. E. Howard. Flanged tube manufacture.
14090 A. Karnbach. Folding frame for hammocks.
14097 J. Hall. Forcing water into boilers.
14100 J. Newton. Water gauge for boilers.
14114 J. Rowley. Water heating apparatus.
14121 G. J. Hay. Vessels for carrying grain.
14127 J. Hayes. Boiler tube cleaning apparatus.
14138 H. G. Hausmann. Lubricating steam cylinders.
14144 E. Raverot and P. Belly. Registering the speed of vessels.
14158 A. Browne. (J. A. Cox and A. W. Read, India.) Life-boat tender.
14181 T. K. Barclay. Condensers.
14184 W. P. Theermann. Steam valves for pumps.
14211 V. Gane. Preventing incrustation in steam boilers.
14215 M. E. D'Engelbronner. Propelling water.
14240 G. Durland and R. T. P. Davenport. Propeller for vessels.
14251 W. P. Roberts. Propeller for steamboats.
14288 J. P. Halket. Stoppers for boiler tubes.

14294 L. P. Perkins. Boilers.
14301 C. Campbell. Folding shaft.
14310 H. Hutchinson. Anchors.
14321 J. Foord. Preventing explosion of boilers.
14323 J. Yates. Screw propellers.
14324 A. H. Tyler and J. S. E. de Vesian. Steam engines.
14325 J. W. Milner. Apparatus for rolling metal bars.
14344 D. Kegler. Furnaces.
14380 M. Muilineux. Steering apparatus for ships.
14393 G. and J. Weir. Tubular steam boilers.
14400 G. H. Blenkinsop. Better guidance of ships.
14408 J. P. Halket. Tubulous boilers.
14414 J. Bergstein. Indicating device for valves.
14421 F. O. H. Haeder. Condensers.
14434 C. A Couch. Promoting combustion in furnaces.
14446 J. Abbot. Fire bars in furnaces.
14447 E. J. R. Baldwin. Sunken ship raiser.
14457 W. Bruce. Water tube steam generators.
14460 H. A. Sawyer. Method of steering ships.
14461 H. A. Sawyer. Self closing watertight doors.
14501 J. Wingfield. Ships' brake.
14515 J. R. Badger. Exhaust feed-water heater.
14520 H. B. Hanna. Construction of ships of war.
14526 D. Drake. Cleansing boilers.
14550 J. F. Murphy. Head-lights.
14559 F. Gautier. Ships.
14564 M. Macer. Injector for steam boilers.
14596 J. C. L. Miller. Life buoys.
14692 C. Inglis. Bearing for axles and shafts.
14720 J. J. Arrowsmith & P. Sinclair. Winches.
14726 J. Clark. Exploder for torpedoes.
14730 F. Glass. Hydraulic lifts and cranes.
14736 R. Henderson. Feed-water heaters for boilers.
14738 J. F. Flannery & S. H. Terry. Ventilation of ships.
14744 G. Dürr. Tubular steam generators, &c.
14762 F. H. Hausman. Water gauges.
14816 A. A. Lateulére. Electro-motor for boats.
14818 A. R. Bennett. Improved steam boilers.
14836 E. E. White. Pumps for raising water, &c.
14848 J. L. Grandison. Sight-feed lubricators.
14861 J. F. Kitching. Links for ship's cables, &c.
14917 H. Ballot. Assisting locomotion in ice-boats.
14944 W. H. Mirfin. Steam generators.
14956 T. H. & W. Blamires. Steam safety valves.
14978 H. Zoelly. Ships' propellers.
15005 E. S. Hough. Automatic water gauges.
15085 C. Pilkington. Stowing springing life-belts.
15086 A. G. Ramage. Thrust blocks of marine engines.
15111 G. Owen. Obtaining information from ships.
15118 A. Millar. Engine combustion chambers.
15119 A. H. Williams. Iron and steel tubes.
15139 J. McKay. Steam boiler furnaces.
15155 S. Handscomb & G. Chamberlain. Furnace bars.
15157 C. H. Gray. Flexible tube manufacture.
15167 A. A. Andrew. Preventing ships foundering.
15184 T. Hampton. Manufacture of armour plates.
15232 R. Kieserling. Pipes or tubes.
15236 D. B. Morison. Supplying air to furnaces.
15245 A. E. Muirhead. Conveying sea-water into tidal rivers.
15249 J. Parker. Valves and taps.
15261 E. Martin. Jointless tubes.
15283 C. A. Wynn. Screw wrench or spanner.
15291 J. Taylor. Cranes.
15296 W. Smith. Feeding apparatus for furnaces.
15318 J. E. Gowen. Stopping the inrush of water into vessels after collision.
15319 E. E. Wigzell. Compasses.
15359 A. R. Bellamy. Travelling cranes.
15360 R. W. B. Sanderson & J. Chapman. Feed-water heaters.
15362 J. Jones. Winches.
15377 W. M. Angas. Securing steam boiler tubes.
15380 J. Y. Johnson (J. P. Serve, France). Steam generators.
15385 H. Mellon & J. J. Coulson. Cooling steam boilers.
15389 L. Epstein. Torpedoes.
15395 J. Musgrave & G. Dixon. Triple-expansion engines.
15440 F. C. Wort. Steamships.
15459 G. T. Whish & J. H. Armour. Device for transmitting the readings of logs to the bridge of ships.
15481 E. Thunderbolt. Quick-acting governor.
15501 J. P. Hall. Steam generators or boilers.
15514 O. Imray (M. Mannesmann, Germany). Tube Joints.
15516 E. Fishwick. Feed-water heating apparatus.
15521 D. Ferguson. Water heating apparatus.
15544 T. Bills. Vessel for the navigation of water.
15554 C. E Hodgson. Pneumatic oars or sculls.
15556 Amies & Co. Funnels.
15568 C. F. Wood. Rams for ships and the like.
15586 J. McKay. Flues of steam boilers.
15619 M. W. Lowinsky. Motor.
15622 A. E. H. Field. Compound asbestos packings.
15623 P. O'Brien. Hulls of vessels.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1C, denotes First Class; 2C, Second Class.

July 29th, 1893.

Blechynden, E.	1C	N.Shields
Butchart, R. J.	2C	„
Clemo, W. H..	1C	Cardiff
Cotton, T. W..	1C	N.Shields
Coulter, A. P..	2C	London
Davies, A. B..	2C	N.Shields
Doughty, H.W.	1C	Liverpool
Hosgood, O. S.	2C	Cardiff
Hughes, G. F.	1C	London
Hume, Thos. H.	1C	N.Shields
Iron, W. L. ..	2C	London
Langridge, J..	1C	N.Shields
Lloyd, J. L.	1C	Cardiff
Mackenzie, K.D.	2C	„
McIntosh, Jas.	1C	Liverpool
McKilloo, W..	1C	„
Parkinson, F.W.	1C	London
Peacock, J. F..	1C	Bristol
Reed, Samuel	1C	Liverpool
Smith, Kirton	2C	N.Shields
Storey, Alex...	2C	„
Syren, Richard	1C	London
Tudor, Hancon	1C	„
Vowles, H. S. R.	1C	Cardiff
Wilson, David	1C	Liverpool

August 5th, 1893.

Adam, James	2C	Greenock
Allan, George..	1C	Leith
Binnie John ..	2C	London
Brenton, J. L.	2C	Liverpool
Brock, Alex. ..	2C	Glasgow
Chisholm, John	2C	Leith
Davis, Thos. W.	2C	London
Forrest, A. W.	2C	Liverpool
Gray, J. R. M'L.	2C	Glasgow
Hall, Robert	2C	„
Hodkin, J. W.	2C	Liverpool
Hutchison, G.B.	2C	London
Mitchell, S. N.	1C	Glasgow
Mitchell, R. J.	1C	Liverpool
Mungall, David	2C	Leith
Pendleton, E.J.	2C	Liverpool
Porter, Hy.Geo.	2C	London
Rennie, Thos..	1C	Greenock
Robertson, R.	1C	Leith
Smith, Richard	1C	London
Tyte, Geo. H..	1C	Liverpool
Workman, E..	1C	Greenock

August 12th, 1893.

Allen, Geo. E.	1C	W. Hart'l
Botham, R. L.	1C	„
Brady, Joseph	2C	N.Shields
Dow, John ..	2C	London
Eyre, Thomas	1C	Hull
Farrar, James	2C	W.Hart'l
Forbes, Robert	2C	N.Shields
Hendrick, Alfd.	1C	Liverpool
Holland, J. W.	2C	N.Shields
Jobson, W. H.	1C	London
Lawrence, F. ..	2C	N.Shields
Levi, Louis ..	2C	Hull
Mayson, Hillyer	2C	W.Hart'l
Metcalf, C. W.	2C	N.Shields
Murrin, Wm. J.	1C	London
Peat, Herbert..	1C	Hull
Prentice, T.S.M.	2C	N.Shields
Richardson, J.J.	2C	„
Smith, Joseph	1C	„
Stark, John ..	1C	„
Thompson, J.E.	1C	Hull
Todd, James ..	2C	W. Hart'l
Whitfield, H. B.	2C	„

August 19th, 1893.

Campbell, Alex.	1C	Glasgow
Chapman, J. D.	2C	„
Clelland, W. W.	1C	„
Comar, Wm. H.	2C	Dundee
Crocker, Albert	2C	Hull
Davidson, Jas.	1C	Glasgow
Davies, D. J.	2C	Cardiff
Donald, A. ..	1C	Aberdeen
Dunipace, Bruce	1C	Hull
Fraser, James	2C	Glasgow
Frü, Jno. Andrw.	2C	Hull
Gale, Frank ..	2C	Aberdeen
Gerrie, Alex. B.	1C	„
Gordon, Charles	2C	„
Greig, George	1C	London
Hall, Archibald	1C	Dundee
Heron, Thomas	1C	N.Shields
Higgins, H. C.	2C	London
Holdsworth, A.	2C	N.Shields
Horwood, H.T.S.	2C	„
Houston, David	2C	Glasgow
Irvine, David..	2C	„
Jenkins, W. R.	1C	Cardiff
Johnston, And.	1C	Liverpool
Jones, Jno. ..	2C	Cardiff
Jones, W. P. ..	1C	„
Kerr, David W.	2C	Dundee
May, Wm. R.	2C	London
McDougall, J.L.	1C	Liverpool
Middlemiss, W.E.	2C	Hull
Millisan, J. A.	2C	N.Shields
Nash, Geo. J.	2C	Cardiff
Page, James ..	2C	„
Parker, Wm. R.	1C	N.Shields
Paul, H. G. ..	1C	London
Piercy, William	1C	„
Pollock, Robert	1C	„
Robertson, Jno.	2C	Glasgow
Scott, Ralph B.	2C	London
Selkirk, Jno.K.	2C	Glasgow
Sivewright, S.M.	2C	Dundee
Smith, JamesF.	2C	Aberdeen
Snow, HenryW.	2C	Liverpool
Swann, Geo T.	2C	Glasgow
Swift, William	2C	Liverpool
Teiper, Henry.J.	1C	Liverpool
Williams, Hugh	2C	„

The Marine Engineer.

LONDON, OCTOBER 1, 1893.

AS a consequence of the World's Fair at Chicago, attention is being directed to the very large water-borne traffic that exists in the large inland fresh water lakes of America. The volume of such traffic strikes us as enormous, as we know so little here of this vast inland navigation, and seldom, if ever, do our shipbuilders or engineers supply the sailing vessels or steamers used in the Lake navigation. It will probably considerably startle our readers when we state that the Sault Sainte Marie Canal, joining Lake Superior with Lake Huron, actually passed in the year 1892, nearly 50 per cent. more tonnage than the Suez Canal, in nearly four times the number of vessels. This astonishing record is beaten by the traffic passing through the Detroit River in 1892, joining Lakes Huron and Erie, through which the tonnage passed was over twenty-one and a half million of tons, whilst only eight to nine millions of tons pass annually through the Suez Canal. The above tonnage represents almost as much as the whole tonnage cleared and entered in the foreign trade in a year in the Ports of London and Liverpool taken together. Say, twenty-four to twenty-five million tons. This is almost inconceivable to us, as we see and know so little of the vast shipping trade carried on on these inland Lakes. It is said that even in 1890, the gross cargoes carried on these Lakes amounted to over thirty million tons, of a gross value of seventy million pounds. There appears to be considerably over one million of registered shipping tonnage on the lakes alone, and these are by no means small vessels, at least 300 of the vessels plying on the Lakes are between 1,000 and 2,500 tons register, a larger proportion of vessels of this size than all the rest occupied in the coasting trade of the Atlantic and Pacific seaboards, and the Gulf Coast and Western rivers, and almost the whole increase for the last two years in the register of American shipping is absorbed in the Lake trade. It may be said that the whole of this shipping is locally built and chiefly of the native oak, as the builders, having boundless supplies of material to their hands, have almost no competition. The cargoes consist outward chiefly of iron ore, grain and lumber, whilst the inward cargoes are chiefly coal. Since the last few years it is reported that the local shipbuilders have largely adopted mild steel in the construction of hulls, but not as with us as plates for hulls, but merely as supports and strengthening pieces to the wooden hulls. Frames, keelsons, planks, ceiling, stringers, beams, &c., are all of oak, but stout steel plates are bolted to the side of their centre and side keelsons, steel sheerstrakes are fitted under the wooden ones, and broad diagonal riders of steel are interlaced between frame and plank. It is not found in the fresh water of the Lakes, which are without salts in solution, that much corrosion is induced in the metal from contact with the wood, as would be the case in sea-borne vessels. As, however, the oak forests are rapidly becoming exhausted, it is probable before long that the building of timber vessels will rapidly decline, and there may be a chance of British competition in this enormous shipping industry when the builders are driven back upon steel and iron as with us.

THE Admiralty have in certain points undoubtedly improved of recent years. Tampering with the original designs of vessels is of less frequent occurrence than heretofore and the completion of ships is now carried forward with commendable rapidity. But there is still much to be learnt by those in authority at Whitehall. The last few days have shown us some of our glaring weaknesses. The torpedo catcher has been an arrant failure. In manœuvres in former years it has been the vessels of the *Gossamer* and *Gleaner* class that have nobly fulfilled the duty of supplying the correspondents with the necessary breakdowns. Sometimes they have barely fetched port. The importance of this class is undoubted, because we have few torpedo boats in comparison with those of other countries. We have relied on our supply of "catchers," and what will they catch? Not foreign torpedo boats, certainly, for some of them on trial attain a speed of something like 26 knots. The latest of our catchers has passed a satisfactory trial doing 18·3 knots. This is an improvement on former vessels of the class probably but it is certainly a useless speed for the purpose for which she is designed. Here is one point of most serious consequence. Another may be briefly referred to. The cruiser class is one that we regard with peculiar satisfaction. It is certainly one that has its work to do in the day of battle. That work, as we take it, is to be the duty of cruising at ten knots speed for long periods together, of making occasional spurts to cut off the passing merchantman, and of acting as the eye of the battleship. Is it possible that these requirements or any of them can be fulfilled by any cruisers in our Navy when we read in the daily press that H.M.S. *Melpomene* has arrived at Vancouver having come direct from Callao without coaling, and that this is, in the British Navy, a feat at once commendable and unsurpassed? She has steamed 5,000 miles in 22 days. That is, done something over 9 knots an hour. What is it? There are Orient boats that have omitted the call at Colombo

as a regular part of their voyage and run between Aden and King George's Sound without any fuss. The New Zealand boats call usually at the Canaries and at the Cape on their way to the Antipodes, but if occasion offers, the halt at the Cape is avoided. We presume that voyages from England to New Zealand are the longest possible to a merchant steamer, for half a circumference of the globe is a maximum. If they wanted to go further the other road round would be the shortest and cheapest route. Yet two steamers, the *Pukaki* and the *Tavinui*, have run from the Clyde to the Antipodes without slowing their engines, and that at ten knots or thereabouts. This in their case was as near their full speed as the *Melpomene* or any other naval ship will ever get except on trial conditions. Where is the ground for boasting here? It is a case for grave uneasiness, not only that this should be an event in the Navy, but also because naval men fail to appreciate the weakness of the service in this particular.

It is remarkable how from time to time the thoughts of inventors and engineers recur again and again to a method of propulsion applied to steamers other than the usual paddles or screws. Occasionally apparently successful trials and applications of hydraulic propulsion serve to rivet attention and to start ingenuity afresh in this direction. H.M.S. *Waterwitch* is one of the most notable examples of an application of hydraulic propulsion on a practicable scale and with some degree of success, but there must have eventually proved to be serious drawbacks for the experiment produced no further useful results. Another and later apparently successful application of hydraulic propulsion was to a steam lifeboat, in the year 1890, which carried out successful trials and was thought much of at the time. It is, however, one thing to design a system of hydraulic propulsion which shall drive a steamer over the water, but quite another thing whether such an application is commercially successful in its results as compared with the best results by paddle or propeller. It is here, we think, that ultimate commercial failure steps in and is the reason why so little has actually been done in this direction. The application of jet propulsion to the lifeboat is explained on quite different grounds from its value as an economical means of propulsion. The objections to the ordinary screw in a lifeboat were serious; as she would be often in broken water and heavy seas, a screw would probably be most of its time out of water and therefore practically useless. Also a screw would be very apt to foul in the loose rigging and spars of a wreck and thus become incapacitated at the most critical moment. From these points of view we can understand the adoption of hydraulic propulsion even though attended with other economical drawbacks. If it is correct, as we have heard in the case of the *Waterwitch*, that whilst the velocity of the escaping jets was 30 knots an hour, the vessel advanced only at the rate of 7 knots an hour, this result alone would indicate a wide margin between the I.H.P. in the engines and the work effected. On broad grounds, in considering this question, it should be remembered that the vessel is pushed forward by the inertia of the mass of sea water played upon by a column of water pushed back to the rear of the vessel by the screw or paddles. And for the least loss of efficiency the column so pushed back should be of the largest sectional area and of the least possible velocity beyond that of the speed of the vessel. In the screw-vessel this principle is recognized in estimating the slip of the screw which is the difference between the velocity of the backward-moving column of water and that of the vessel itself The column of hydraulic propulsion to be even on the same footing of effectiveness as the screw should at least throw back a column of water as large in diameter as that of a suitable screw propeller for the vessel, and at a speed as little as possible above that of the vessel itself. Any departure from these principles in making the propulsion jet smaller in diameter and of corresponding higher velocity is certain to result in a larger amount of slip, and therefore of lost e ciency as compared with the screw. The size, therefore, of the suitable water tunnel and of the apparatus to deal with it at slow velocity would be thus enormous. As far as we can see the dimensions of the operating propelling mechanism and tunnel amidships can only be reduced by a funnel-shaped tunnel at the entrance and exit, drawing to smaller dimensions and corresponding higher velocity of movement at the operating mechanism. We do not know that this principle has ever been embodied in hydraulic propulsion, but the restriction of passages and the change of speed in the propelling water column would be disadvantages as compared with uniform area and speed. With regard to propelling mechanism, it is not very hopeful to suppose that pumps or turbines with all the accompanying steam engine driving gear can be made to operate a travelling column of water with as great an efficiency as a screw, which has undoubtedly the merit of simplicity. In our opinion the only line of suitable research in jet propulsion is to throw over the usual mechanism altogether, thereby saving cost of machinery, and loss by friction of wearing parts, and expense of maintenance, and go boldly for a dynamic jet apparatus of the injector or ejector principle, in which the propelling column is set in motion by the dynamic action of the steam itself. To maintain, however, the principles we have laid down abcve as to the necessary

area and low speed of the water column for effective propulsion of the vessel, we have before us a slow speed ejector of a size and capacity outside everything at present known of the kind, and the transfer of the dynamic force of a high-speed steam jet to an enormous column of slow speed water is a problem of which the solution is not easy to foresee. We commend it to our readers' ingenuity.

INSTITUTE OF MARINE ENGINEERS.

THE TESTING OF BOILERS.*

By Mr. J. F. Livesey, of Valparaiso (Member).

To maintain the safe working condition of boilers is, to a great extent, the all-important duty of marine engineers entrusted with their care. To ensure this safe working condition, boilers are periodically examined and tested by experienced engineer-surveyors in addition to the regular examinations by the engineers in charge, that take place whenever there is an opportunity.

To plunge into this subject previous to offering an explanation as to my reasons for so doing, would be liable to create a wrong impression, and I may state at the outset, that my principal reason for presuming to deal with so important a subject was to obtain, by free discussion, information beneficial to myself and others similarly situated in positions far removed from leading centres. I feel certain that, in introducing it to the notice of this Institute, it can be dealt with theoretically and practically, and I look forward to a result which can guarantee that we have given it the consideration its importance demands. I hope members will not be sparing in their efforts to point out the defects of what may hereafter be given in the paper.

I cannot lay claim to suggest anything that has not been said or done before; in fact, I hope by your friendly criticism to obtain information otherwise unobtainable, my ideas, most likely, not being quite up to date, but my impression is that, however incomplete on my part, the subject, if taken up by our members, who are experts in this special branch of our profession, who have opportunities for obtaining experience and sound judgment, by their attendance at places where the various tests of materials are carried out, the working up of these materials into boilers, and, finally, directing the hydraulic and steam tests when the boilers are completed, can be thoroughly analyzed.

I think many will agree with me in saying that there is a scarcity of information as to proper methods of boiler testing. Several excellent books on boilers are to be obtained, and much information is contained in them relating to the various experiments in the testing of plates, joints, rivets, and the several designs, methods of construction, and other details that one may require to know, but I am not acquainted with any work in which there are six pages treating upon the testing of boilers.

Testing by water-pressure to double the working load to the satisfaction and approval of the surveyor responsible for the test, is the usual standard, but many with an inquisitive nature endeavour to understand the "why and wherefore," and when so much diversity of opinion exists as to what is a reliable boiler test, a candid expression of opinion may do much towards settling a few knotty points.

Many condemn the practice of testing boilers by hydraulic pressure to twice the working load, as the condition of a boiler in actual work is altogether different, and that a boiler may be unduly strained by a test-pressure, double that at which it is intended to work under steam, but in specifications for new boilers it is generally stated that such a test-load must be applied. In one sense there is no valid reason against this, as no question of undue straining should arise here, seeing that the boiler should be designed and constructed to withstand satisfactorily the specified test load. Of course we require, in most instances, a boiler as light as is possible for the production of a stated volume of steam per minute or per hour, or, as much steam as possible produced in a vessel of as little weight as is consistent with safety. You are all aware that the test-load is decided for a given boiler by calculating the strength of the materials used and the dimensions of the several parts, using "factors of safety," based upon experience gained by the engineer-surveyors of the Board of Trade, Lloyd's Registry, and the several Boiler Insurance companies. My opinion is that this test-load of double the working load is not excessive, and could not, in the interests of safety, be reduced for new boilers, until such time as there are no elements of doubt connected with the construction of boilers; but sunken rocks still exist, especially in boiler shops where the *punch* and *drift* are very accommodating tools. In a number of cases the hydraulic test-load has been the means of showing up defects otherwise not detected, which might have been the cause of serious accidents. One notable case was the boilers intended for the *Livadia* (it is perhaps unfair to allude to it at this time with our improved understanding as to quality of material) but it was one of the notable cases of failure in which the whole set of boilers was condemned. I have taken the following extract from the Marine Engineer of May, 1881, in which issue there was published a paper that had been read by Mr. Parker at the Institute of Naval Architects:—

"On subjecting the first boiler to hydraulic pressure, before the test-pressure of 140 lbs. per square inch was reached, the boiler-shell tore asunder in three places, the cracks appearing to have started among the rivets of the longitudinal seams, and to have extended at the back of the rivet heads across the plate. In the second boiler which it was intended to test, the shell-plates were found to be cracked in a similar manner behind the rivet holes, before any water had been put into the boiler. Here was a material which had satisfactorily withstood all the mechanical tests recognized by Lloyd's Registry, the Admiralty, and the Board of Trade, as sufficient to determine its suitability for the purpose for which it was being used."

An occurrence similar to the foregoing may take place at any time in the case of boilers that may be undergoing a similiar test, and, as Wilson puts it, remind us of our fallibility. The failure of the first boiler was due, I understand, to faulty material or bad workmanship, but whatever the cause, the defect escaped detection until the hydraulic test was applied. The second boiler which it was intended to test, was, no doubt, more thoroughly examined to discover the cracks afterwards found; these cracks could not have been caused by anything but faulty manipulation of the plates, either at the manufacture or during construction. With such a case in view we see the importance of applying the hydraulic test previous to raising steam, although the various stresses set up may be entirely different from those that occur in a boiler under working conditions. So far as I am informed, there is no safer method of finding the weak spots which may have escaped notice in the most searching examinations of finished boilers. Mr. Wilson, in his "Treatise on Steam Boilers," says—"Let a boiler be ever so carefully designed and constructed according to the knowledge acquired by careful research and long experience in the strength and disposition of its materials, and let every plate be tested before it is put in, there will still remain an element of doubt as to the actual strength of the boiler, since the material may have sustained injuries in the process of construction which have escaped detection." Such a statement from so well-known an authority carries *great weight* in influencing the impressions formed by men whose duties do not permit many opportunities of observing the various stages of the construction of boilers, so that when called upon to undertake the duty of testing and assuming the responsibility of fixing a working pressure, it is frequently done with a feeling not quite *solid* as to what the test-pressures should be, having on one hand the fear of over-straining and on the other a doubt as to whether such or such a test-pressure will allow a safe margin of safety for contingencies which may arise from one cause or another. This state of mind does not warrant an accusation of nervousness or incapacity against an engineer so called upon to decide a safe working pressure, but so many of us on foreign service are out of touch with the latest practice "at home," and so entirely dependent on our own resources that the state of feeling I have indicated is very apt to arise. Oftentimes in a conversation with owners in regard to the qualities of a steamer, engines, boilers, &c., men are told to do their utmost "to get as much speed as possible," and where there are no restrictions preventing them attaining this end the working pressure is fixed by a prudent man—who wishes to do his utmost and still keep clear of accident—with feelings not quite free from doubt at times. In the event of anything occurring he, if he survives, is oftentimes blamed, although he may have carried out to the letter all that could reasonably be

* Read at Gresham College, Basinghall Street, E.C., on Monday, 11th September, by the Honorary Secretary. The President, Mr. W. H. White, C.B., LL.D., F.R.S., in the Chair.

expected from him. In many instances an official enquiry cannot clearly determine to what extent the accident may have been caused by structural weakness, carelessness, or one of the many contingencies, such as "factor of safety" of 6 provides for.

Steamers trading in remote quarters of the globe with the machinery in charge of English-speaking engineers are principally those I refer to. Now to avoid any undeserved censure when an accident occurs, I would suggest that an indicating arrangement be in communication with the boiler, whilst undergoing the "test," whether it be the "hydraulic" or "steam." I am not aware of any special instrument for the purpose, nor whether it is customary—at the present time—to take a "test-diagram" whilst boiler-testing, but I think it would be a satisfactory course to pursue, more especially when the chief engineer is entirely responsible for the test. It would be a simple matter to produce a reliable instrument for the purpose, so I don't think it necessary to describe in detail what would be necessary, any further than a pressure indicator or recording pressure gauge, whereby the gradual rise in pressure and the time taken would be recorded, also the time the "full-test load" was kept on, as well as the time taken to reduce the pressure to that of the atmosphere and test completed. To make the operation a little more complete, a diagram should be taken, this could be kept for reference. The reverse side of the card to be a printed form to be filled in with principal dimensions by the engineer responsible for the test.

As to gauging the different parts, I am of opinion that an opportunity exists for someone to devise a suitable gauge, indicating to a third place in decimals, any alteration in form of the parts of a boiler under test. Of course, more than one gauge would be necessary, but the principle of being able to detect the slightest alteration should be the aim in devising them. If we cannot detect at the instant when an alteration in form commences so as to compare the pressure, there is the liability of losing the true value of the test. In applying gauges I think the weakest parts of the structure should be fixed upon, but the difficulty is, that, in many instances, it requires the hydraulic test to find them out. However, as we are fully aware that there are certain parts known to be weaker in proportion than others they would most likely attract attention. One thing seems very clear, that is, that the amount of material in a given structure is constant—in so far as testing is concerned—and a change of form in one direction must produce alteration of dimensions in other directions, and as furnace tubes are more liable to a change of form than other parts of a boiler, I would suggest using a gauge that would be free to accommodate itself to the change of form, say, in two directions—vertical and horizontal—indicating on a graduated scale the amount, which could be seen at the instant an alteration commenced. If some such instrument would be considered of service by members whose experience in testing would justify their opinion, I am sure it would not be difficult to make one. I am, perhaps, too exacting in requiring indications to a third place in decimals, but the nearer to it the better for all gauges used in trying parts whilst testing.

The shell, when subjected to internal pressure, is less liable to a change of form than other parts of a boiler; but, unless in the best of boiler shops, the truly cylindrical form is seldom obtained, consequently the internal pressure when first applied may cause strains on certain parts somewhat in excess of the estimate. For instance, if the shell of a completed boiler measures, say 12 ft. 4 ins. for the horizontal diameter, and 12 ft. for the vertical; if these diameters are to become equal under the test-pressure, the mean diameter would be 12 ft. 2 ins. Does the shell come in horizontally and go out vertically to bring about this equality? or does it remain with the diameters unchanged under the test-pressure? Certainly, near the end plates I should expect very little alteration in that respect, but at mid-length there might be a difference which would cause a leaky joint. The shell of a double-ended boiler has quite its full weight at mid-length when the combustion chambers are held up by it. If such a thing occurred as the horizontal diameter of the shell coming in the two inches as supposed, it would be very severe on the combustion chamber and its attachments. These apparently insignificant details are sometimes overlooked, perhaps, deservedly so, but as we move on towards attaining a why and wherefore nothing should be left unconsidered which may tend, in however slight a degree, to upset theoretical inaccuracy. Exaggerated examples, such as the one just supposed, will convey my meaning more clearly than if I were to explain by the theory of strains that the combustion chambers of double-ended boilers may possibly, under certain conditions, be affected by the internal pressure acting upon the shell. So far as I am informed leaky tubes are not so prevalent in single-ended boilers, although they may be worked under conditions similar to the double-ended. There are so many unaccountable occurrences, that to obtain proficiency and self-reliance in this special branch of our profession, we must be continually following up the latest views, experiments, and practical results, and as this information is difficult to obtain by many of us unfavourably circumstanced, without it we may be a little wide of the mark in expressing an idea.

In the foregoing remarks I have endeavoured to show the necessity for—

(1) More information about "boiler testing."
(2) That an indicating instrument should be used in connection with a boiler being tested.
(3) That the gauges used should indicate the slightest change of form, and the amount, in the parts gauged.

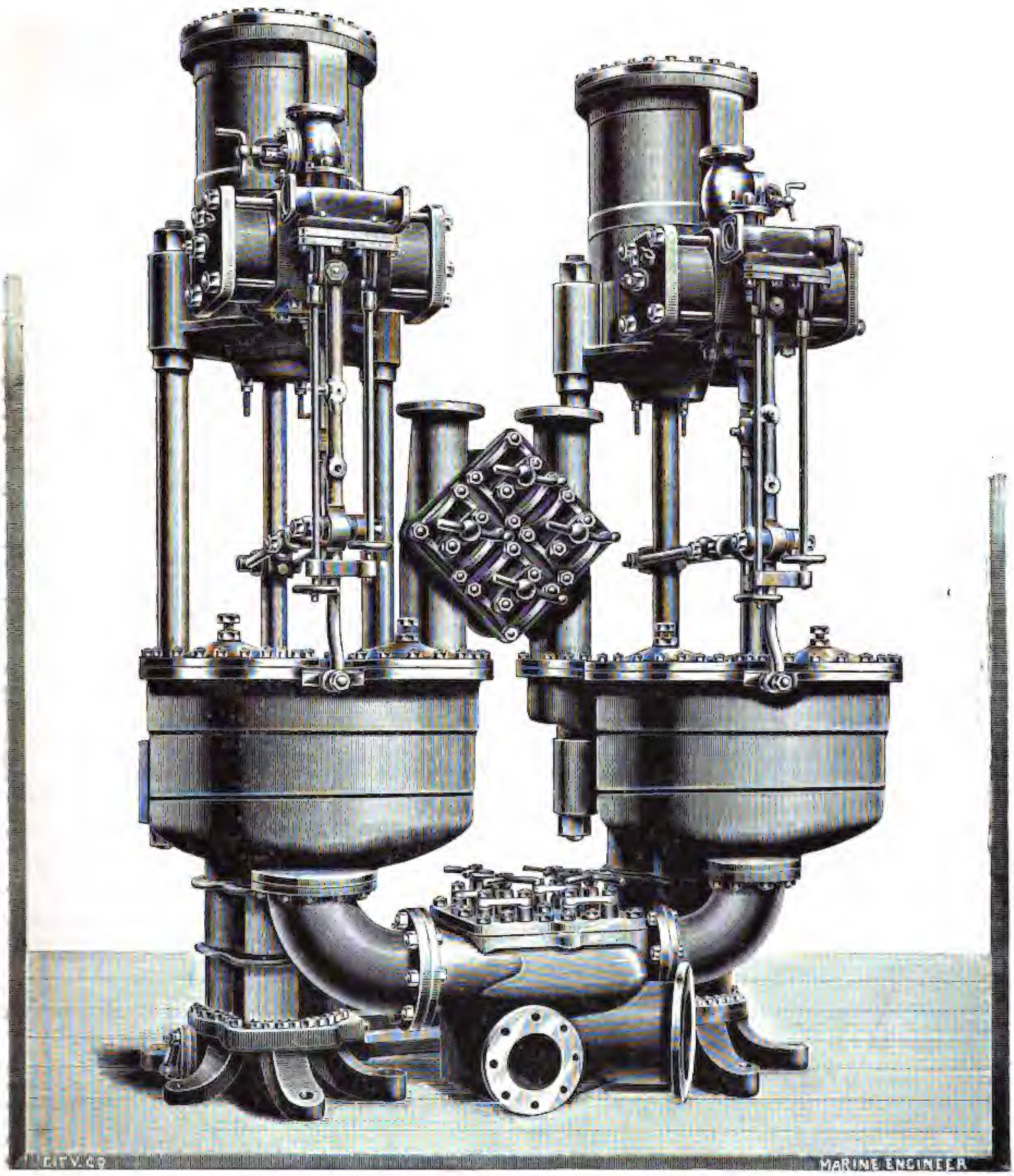
In the following I intend quoting from various authorities whose writings I have studied, in the endeavour to obtain a foundation to work upon. We are told that in many cases "the steam-pressure is not the greatest force a steam boiler has to bear, not the actual fluid-pressure we have to contend with, but the outcome of the unequal temperature of the different parts." The amount of force exerted by heat and cold in the expansion and contraction of metals is equal to that which would be required to stretch or compress it to the same extent by mechanical means again. "There are certain strains which boilers are subject to, which are, under certain conditions, greater than any the working pressure can bring upon them, and which are altogether independent of the factor of safety employed; these are the strains brought upon the boiler by the unequal expansion and contraction of its different parts. Ordinary wrought iron plates, if left free from stress, expand ·0000064 of their linear dimensions for each degree Fah. increase of temperature. Also if the plates are subjected to stress they alter in length a certain amount according to the quality of the material, the more ductile irons altering more for the same amount of stress."

As to these stresses caused by expansion and contraction, they, under certain conditions, figure out to tons per square inch. The hydraulic test of say 400 lbs. per square inch looks insignificant by comparison; more is to be taken into consideration than design, dimensions or material, although these may be the leading points; fractures occur mysteriously in some boilers whilst others, similar in all respects, receiving the same treatment are worked for years successfully. Knowing this, it is not surprising that an element of doubt exists, notwithstanding the great improvements made in late years, for the pressures now in demand are high, and apparently the tendency is towards higher pressures still.

In raising steam in locomotive boilers, the greater part of the expansion takes place—as measured by the length—before there is one pound of steam-pressure. There is suitable provision made for this expansion, the boiler sliding on the frame about $\frac{1}{16}$, the front end being secured. The difference in length shows at the firebox end. This extension, of itself, is a sort of test, for if prevented from extending by faulty design, rigidity or other causes, stresses of tons per square inch would be produced before the steam-pressure exerted any force. An accident accruing would certainly not be so serious as if there were so many lbs. pressure in steam, and in view of this, I think all new boilers should be so tested, even before the hydraulic test of double the intended working pressure. Many fractures have come to the surface whilst raising steam, or rather, raising the temperature of water to boiling point, and to me it seems reasonable that the stresses of tons per square inch should be first dealt with. Filling up the boiler with hot water and applying pressure does not take in what I consider should be the principal aim in testing, it is so different from the ordinary condition of things in boilers under steam, and does not produce strains similar to those set up when fires are lit. When anything does occur, it is more satisfactory when we are able to determine whether the cause should be assigned to fluid pressure or strains altogether independent of a factor of safety. For instance, a boiler with insufficient freedom and strongly resisting the expansive forces, would be more likely to be overstrained and show by leakage if the operation of lighting the fires and raising the temperature of the water to boiling point were adopted, than one merely submitted to hydraulic pressure. But even if the over-

straining were not detected at the time the fires were in action, it is very probable that the hydraulic test-pressure, when applied, would show up the defects. These tests could be carried out without incurring danger, and anything done to prevent accidents or personal injury is to a great extent time well spent. We have that a diversity of opinion will always exist on this subject, and what would be accepted as a true test in one case would not equally apply to another.

The Engineer, describing the conditions for testing boilers at the Great Northern Railway Works says: "The boilers are



Main Engine Feed Pumps, constructed for the s.s. "Lucania," by Messrs. G. & J. Weir Cathcart. (*See page* 274.)

two—perhaps more—entirely independent sets of forces requiring a separate test for each, if we are to judge correctly whether a defect noted is due to fluid pressure or to an excessive or insufficient allowance for "breathing freely."

The several methods of testing have their advocates, and it cannot be denied that the reasons given for or against any particular method should be impartially considered. It is probable never tested hydraulically but under steam, the pressure for the 160 lbs. boiler being taken to 180 lbs. Many will condemn this practice as unsatisfactory and unsafe. We are inclined to approve of it more than of the hydraulic test, which, in many cases, being taken too far, damages the boiler. If the boiler is thoroughly well made, there is no reason at all for not using the steam pressure test, as the boiler is then under exact working conditions;

the strains, due to expansion, being set up, there is no need to force the pressure beyond reasonable limits, and the test is really more trustworthy."

These conditions of testing are all-sufficient for new locomotive boilers, when, as in many instances, the whole of the material has been manufactured and the boilers constructed at the company's works, where perhaps a change in their standard design for a certain class does not frequently take place. The factor of safety used in determining the working pressure is usually greater in such cases, when the 10 or 12 per cent. above working pressure may be approached with confidence. Certainly it is the only true test and takes in all that has been said in its favour. I have on several occasions tested locomotive boilers on exactly similar lines and experienced a feeling of relief when the test was over. I was not acting for the purchaser on these occasions, but responsible, to a certain extent, for a safe working pressure. I question whether such a course would be prudent with marine, or any boilers in which the strength of the furnace tubes depends entirely upon their retaining the circular form under pressure, seeing that this part should be accurately gauged, which is only possible with the hydraulic cold water test. Then again, the great weight of marine boilers, and their liability to damage in transfer between the boiler works and the stokehold, calls for a more cautious course than raising steam-pressure before they have been tested hydraulically, or, at least, not until we are more conversant with the expansion strains of tons per square inch. I must confess my inability to deal with these strains in a manner sufficiently intelligible; they are a difficult problem, and I hope that expression of opinion will not be wanting in regard to this question. It cannot be treated at great length without involving questions of construction, design, material, and, lastly, treatment, especially treatment the first time in raising steam. I think if the indicating instrument was used on these occasions we should have less forcing, if it were specified that the raising of steam from cold water should occupy such a time, then, as the pressure is gradually raised to working pressure, it would be recorded and submitted for approval or disapproval, as the case may be. Not only as a builder's steam test would the indicator be instructive, but at all times when raising steam, more especially with the high-pressure boilers at present in general service, it would also be the means of protection against an accusation of carelessness in raising steam too quickly. In many ways, too, it would be found a useful instrument in any engine-room; if all steamers were provided with one, it would not be thought an unnecessary refinement after a trip or two, and I venture to add, would be oftener used than a pitchometer. To complete the boiler-testing outfit, we should require the gauges, as before-mentioned, a set, and endeavour to become as familiar with them, as most of us are at present with an indicator, and, if possible, adopt terms so that there would not be confusion or misunderstanding of the meaning intended when results were forwarded. To demonstrate the utility of the outfit, when a chief engineer wishes to forward to a superintending engineer at home the results of a boiler test, which perhaps was not so satisfactory as could be wished, if he were able to forward a test-diagram, and the results of the gauging, as per the standard set of gauges, independent of the ordinary report, the superintendent would be able to judge more correctly of any particular case, such, for instance, as the following: Three boilers in a ship, working at 150 lbs., one of the boilers had deteriorated more rapidly than the others, there being an indication of weakness in one furnace tube. In testing, it was found that a change of form commenced with a water-pressure of 200 lbs., it would not be prudent, under the circumstances, to proceed further, and probably the chief decided the working-pressure to be 130 lbs. This reduction of pressure takes place in the three boilers for a time, although two of them are good enough for the original pressure of 150 lbs., and would materially affect the economic working of the department, more especially if a certain speed must be kept up at any cost. Of course a strengthening ring or bridge could have been fitted on the faulty tube, had there been time and material at hand, but whatever may have been done in such a case, a better understanding between the superintendent and the chief would result if a test-diagram were the means of communicating what had taken place at the test.

As to the various tests which the materials undergo that are intended for use in the construction of boilers, "What do these tests guarantee?" I may answer, "they guarantee only the quality of material at the time these tests are made." The plates intended for use are not tested, but only test-strips cut from them, and I see results often recorded in which two strips cut from the same plate are not alike, by tons per square inch, This difference in results, so confusing to the uninitiated, may be brought on by certain treatment after the plates leave the rolls, by a process of annealing, tempering, doctoring, or whatever may be the proper term to use for the process. However, it seldom occurs that in general practice we are much troubled with the solid plate in so far as tensile strength is concerned, until a certain amount of corrosion or wasting away takes place. I read that "annealing reduces the tensile strength of steel plates, elastic and ultimate, by $1\frac{1}{2}$ or 2 tons per square inch, and the elastic and compressive strength by twice as much." I dare not venture an opinion as to what these tests should be, there seem to be so many standards, but one point is agreed upon by most authorities, viz.: The limit of elasticity is of greater importance than tensile breaking strain.

One important point in a finished boiler is the joints, those being a certain percentage of the strength of the solid plate according to the style of joint, the amount of material taken out for the rivet-holes, etc., in addition to the liability of damage due to workmanship. Although the workmanship may be as good as possible, there must be a tendency to slightly alter the quality of the material in the vicinity, for whilst the joints are being rivetted up, the plating surrounding the rivets is certainly of a higher temperature, whilst the rest of the plate remains nearly at an uniform temperature. Assuming this to be the case, a certain amount of contraction must follow, whether with a detrimental effect or not I cannot say, but a great number of accidents are recorded in which it has been proved that the cause has not been due entirely to either originally bad material or design.

* "It is unsatisfactory and dangerous to work steel at a blue or a black heat. The results have been summarised as follows:

(1st.) Initial strains existing in steel are not eliminated by raising to a blue heat. The heating must be continued to full redness before such strains are got rid of.

(2nd.) Steel strained at blue heat and allowed to cool continues in a state of strain and is much injured; this injury is much greater than if the steel has been strained while cold.

(3rd.) Steel which has been injured by strain at a blue heat is restored to its original condition by raising it to red heat and allowing it to cool."

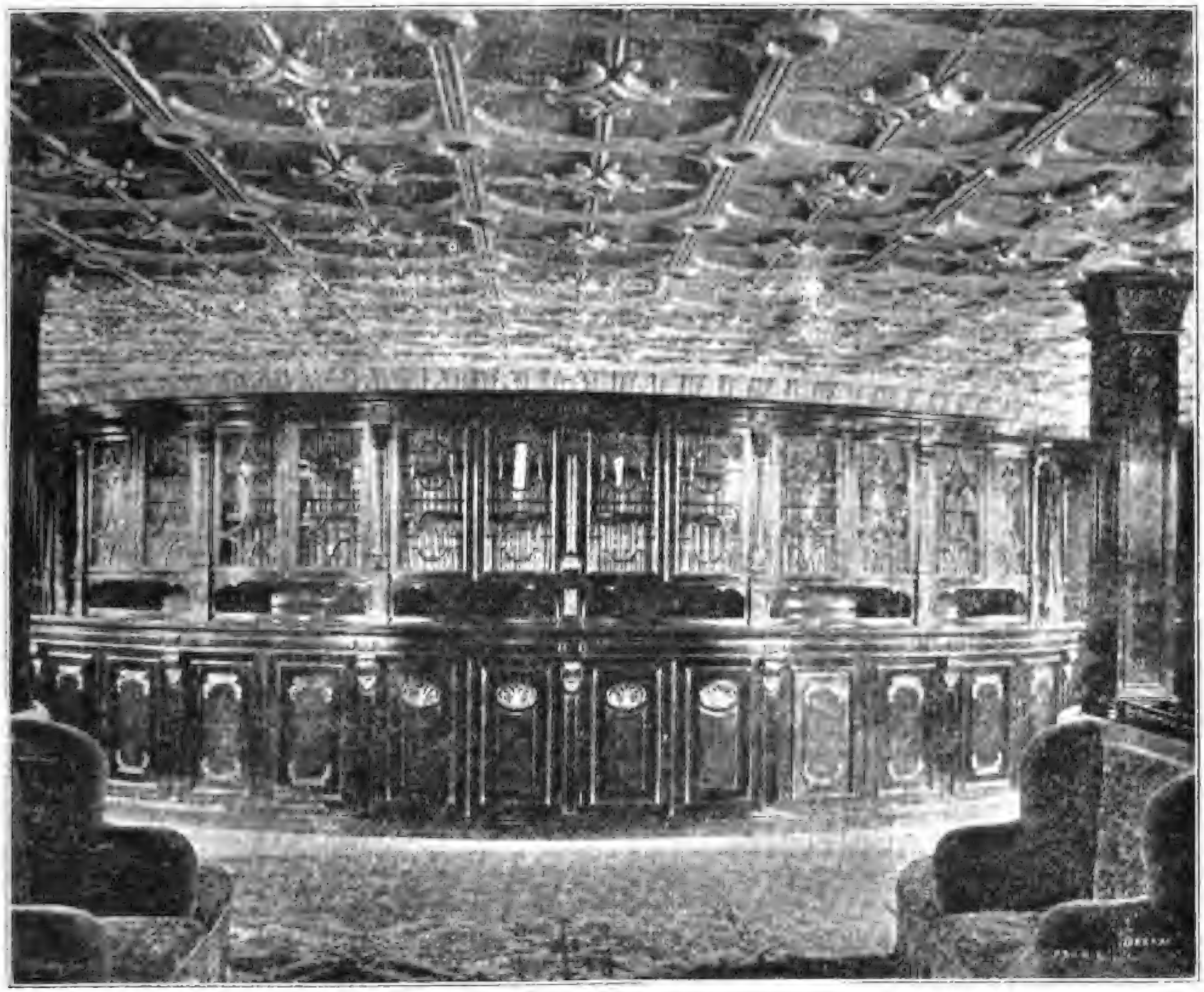
It may be said of steel, that, being the popular material for boilers and likely to remain so for a time, improvements in the making and working of it may continue until the fear of over-straining a boiler made of it—by applying a hydraulic test of double the working pressure—is entirely removed.

Generally speaking, in many cases the shell is the least cause of anxiety, judging by the few experiments undertaken to determine their bursting strength, as also by the comparatively few accidents recorded in which the primary cause has been due to weakness of the shell. With the furnace-tube quite the reverse; the various designs, the changing factor of safety—as experience is gained—the occasional come down without any apparent cause, the mysterious cracks, and other failures tend to show that we still require further experiments. If experiments could be carried out on the furnace tubes under conditions similar (as to temperature) to ordinary working, we should be in a better position to judge correctly what the principal points are to ensure safety and freedom from collapse.

In a paper lately read by Mr. D. B. Morison, before the N. E. Coast Institute of Engineers and Shipbuilders, the testing of the various designs of furnace tubes, the materials used in their manufacture, their resistance to collapse, their qualities, good or bad, the influence of temperature on the strength and ductibility, and other data valuable to all engaged in the construction and working of boilers, were fully treated. As many of you, no doubt, have seen the information referred to, I hope my reference to it will not be thought out of place, as there are so many good things in it, and the discussion which followed the reading cannot be too widely communicated amongst marine engineers. The experiments made by the late Dr. A. C. Kirk, to determine the difference of temperature between the fire and water sides, are the nearest approach to testing the material, under conditions similar to what would be expected to

* Economics of Iron and Steel.

take place in the heating surface plates of a boiler under steam, that I know. The testing of the rival designs of furnace tubes up to 800 lbs. per square inch, by hydraulic pressure does very well as a comparison of the various tubes, but, nevertheless, we hear of furnace tubes of similar material and form to those tested, failing under a steam-pressure of 150 lbs., and it tends to upset confidence. There is no doubt very much depends upon treatment, but I would ask—are the identical tubes which are tested ever worked into a boiler? In the various sketches shown, the tubes in the testing apparatus appear to be joined, by rivetting, to an outer shell, which of course will be stronger than the tube to be tested. These sample tubes would be generally the best of the class they represent, fewer failures under steam. When all is said and done, a failure often reflects discredit upon the makers of these furnace-tubes that fail or come down, and it would be an advantage, were the makers able to guarantee that every tube made by them had been tested before leaving their works to a pressure, say 25 per cent. above what is intended for the official hydraulic test of the finished boiler. It is the general practice with water works engineers to specify that all the larger sizes of pipes be tested before leaving the works, very often to a pressure more than double what they are intended to be worked at; I think we might imitate this practice with advantage, with the difference, of course, that instead of an internal pressure, as with the water mains, an external pressure should be applied. Going a



S.S. "Lucania." The Library. (*See page* 274.)

and, I suppose, manufactured for testing, not for actual use in a boiler. The cutting and punching out of the rivets which join the tube to the testing apparatus would alone condemn their being used in a boiler intended for use, at least such is my opinion. I do not think it can be considered a far-fetched idea to suggest that it would be an advantage to all interested to test every furnace tube previous to being worked into boilers. A special apparatus, of course, would be necessary for the different sizes, but so designed, that the tube, after being tested, would not, in any way, be unfitted for further use. If such a system of tube-testing became the practice, and no furnace-tube was turned out from the manufacturers unless so tested, in the presence and to the satisfaction of an inspector, I think there would be little farther, I would say—make the furnace tube testing machine suitable for either steam or water, and after a tube had been tested to 500 lbs. by water and found perfect, a steam test of 200 lbs. could be safely tried. If found satisfactory, a tube, so tested, could, I think, be guaranteed for 160 lbs. working pressure. Many hundreds of furnace tubes are at present in use, that have not given the least trouble, on the other hand, many have been less fortunate. I sailed in a steamer in which three out of eight furnace tubes had to be cropped. After making a first voyage, with new boilers, at the termination of the second voyage, all the engineers could caulk left-handed. I was third engineer in that steamer, and got my full weight of the caulking. Ever since I have been very partial to thoroughly testing furnace

tubes, which may account, to a certain extent, for what may possibly be considered hyper-criticism in the suggestions I have given.

The experiments and testing of riveted joints are numerous, and the results obtained by the several gentlemen who have carried out these tests, do not in many instances correspond; but we cannot go far wrong if we rely upon the information given by authorities whose experiments have been undertaken to determine points upon which there was doubt. The most recent information that I am aware of, with regard to riveted joints, was given in a paper by Professor Kennedy, read before the Institution of Marine Engineers. Amongst other tests some were made to determine the stress required to produce visible slip or give, and it was said "the load at which visible slip commences is probably proportional to the load at which leakage commences in a boiler" (under test I presume). If we were sure that slip did take place in joints whilst a boiler is undergoing the hydraulic test we must admit that the slip back—when the pressure is removed—is perfect, in many cases, if tight joints are the standard from which we decide. Uniformity in the strength of joints is now generally obtained in good work, but whether all the rivets take an equal share of the various stresses is not quite clear. In the first place, I have not often seen new boilers perfectly tight until steam has been raised, or the water in them heated to boiling point, and I judge from this that not until such is done do the rivets take up an equal share of the strains. It often occurs that one seam may require caulking under repeated hydraulic tests, whilst others in every respect similar are tight and do not require touching. I have not taken notice whether these leaky seams have been the joints last riveted up in the several courses, but in trying to find out a reason for these differences in riveted joints, I am led to think that there would be more liability of the holes in the last joint not being quite so fair as the others, although the plates were drilled in place, taken apart to be slightly counter sunk, and as much care taken in every way to ensure as good work as possible. The last joint in a course must be credited with having to submit to a little more navigation than the others. Twelve months of my seven years' apprenticeship were served at boiler-making, and during that time several instances of unfair holes and the remedies came under my notice. Of course, the methods of that date would not at the present be tolerated, but I find it difficult to completely eradicate from my mind some of the early impressions formed as to rivet holes being made fair and specially shaped rivets inserted. It often occurs in testing that a bad rivet cannot be detected, the leakage caused by it showing up at some distance, and often bothering even an experienced boiler maker whilst the pressure is on.

It would be a rather difficult matter to mark out a course which would be accepted as the correct one to adopt in applying the hydraulic test, so long as opinions differ. At first sight it would appear as if all that is required, is to pump up to the desired test-pressure and have done with it. However wrong it may be, it is sometimes done, the test really in such cases being a mere matter of form. That such a practice carried out on the hit or miss principle is bad I need hardly say, and cannot be considered of much value in determining the suitability of a boiler for a certain pressure. Very often, when a boiler is designed to withstand a certain pressure by test, and through some apparently insignificant detail, it shows signs of weakness before the test-pressure is reached, the pumping goes on, the idea being to see if anything else gives out, so that one job can be made of it when it comes to strengthening. Such a principle is wrong, and has been the means of many purchasers rightly thinking that the hydraulic test when carried too far damages the boiler. I say at the first sign of weakness occasioned by a certain pressure, either let that pressure be accepted as the test-pressure, or strengthen the weak part before proceeding to find out whether another part will give out at a higher pressure. It is without doubt very annoying to all concerned when the testing cannot be approved after two or three trials and the boiler passed.

In carrying on a hydraulic test there should be no hurry to obtain the maximum pressure, the more gradually it is raised the better, getting rid of the air from parts where it is liable to accumulate. I have known cases, when this precaution has been neglected, in which the pointer on the pressure gauge was anything but steady, and one is apt to attribute this unsteadiness to other causes. The steady rising of the pressure, as indicated by the gauge, at a fixed speed of test-pump is often valuable as a sign of the absence of leakage, when a boiler is so situated that all its parts cannot be seen.

The caulking of leaky seams whilst the pressure is on is by some condemned, whilst others—myself included—are of opinion that the seams can be more efficiently touched up when there is a slight pressure holding up against the caulker. There certainly is more solidity and the principle insures more care being taken. I have known many cases when this has been done at the hydraulic and steam tests with success.

My first experience in testing was at quite an out of the way place. The water for testing was in the first instance brought by rail a distance of 24 miles, then conveyed by mules to a spot in the mountains about two miles distant from the railway station. After filling the boiler—it took a week to do it—we tested, caulked, built in the boiler and raised steam with that same water. The seams we touched up with a caulking tool whilst keeping a pressure of 60 lbs. per square inch. The test pressure was 120 lbs. per square inch, and the whole affair a creditable job. In another case—not in the mountains—I found it necessary, whilst testing, to point out defects that could not possibly be repaired without working inside the boiler. Then after this, another trial, when some other defects would be seen at a slightly higher pressure, and so on until a fortnight had been taken up in touching up and testing, and the makers were full up of the idea that testing by hydraulic pressure was damaging the boiler, when really only showing up the weak spots. Had the full test-pressure been applied in the first trial I think damage would have been done to that part showing signs of weakness, and for this reason I think there should not be hurry in applying the test. Of course, time is money, but when a boiler is not inspected during construction one is more inclined to be a little generous in this respect when it comes to testing and having responsibility of accepting and working the boiler afterwards.

In concluding these remarks I am fully aware there are gaps that can be filled in, and that what has been written may not be quite in touch with the opinions held by specially trained experts. Nothing new brought forward, not even quite up to date, but for years I have been so interested and oftentimes puzzled by seeing differences in the results of experiments. The conflicting statements sometimes made as to what is, or is not, a true test, that I am under the impression that an important service will be rendered to all interested, if by contributing our mite to the general fund we can show that some things are not quite clear to many of us situated at a distance. I have also endeavoured to show that we require more information with regard to the strength of materials at temperatures under which they work, which really is the condition, when all is said and done, upon which depends safety.

THE "LUCANIA."

It is but the other day that I came across a contemporary account of the launch of the first ocean Cunarder, the famous *Britannia*. In the light of what has happened since then I may be pardoned if I quote a few lines before proceeding to the description of her giant sister. In the first place it is very noticeable that the style of describing these occasions has not varied with the progress of the century. We have a reference to the "magnificence of the accommodation" and to the improvements introduced, "the dining saloon is unique," and "it may be safely added that everything from the keel to the topmast will be found substantial and adapted to the course the vessel is to take." So the great line started with a reputation for good work, acquired from Messrs. Napier's previous achievements, and though topmasts are things of the past, and keels have considerably altered, the same praise can still be awarded to the *Lucania*.

Though the launch of the *Britannia* was rightly considered to be an event of the first importance in the maritime history of this country, and, indeed, in the history of civilisation, she was not such an advance on previous work as is her successor of to-day. The advent of the *Britannia* was important because she was to be quickly followed by three duplicates of her-

, and because these were to be the heralds of ular communication between the Old World and New. She was not an advance on previous ctice to anything like the extent that are the sent sisters. The *Great Western* had crossed two rs previously, and she excelled the first Cunarder ize, and was probably a very fair equal in speed.

Scotia. These were vessels of 15 knots on trial. Then things stood still for many years. The maximum had been got out of the paddle for a long voyage, and the screw was not believed equal to the older arrangement for speed. Ten years were lost in making the screw efficient and in perfecting the compound engine, and then the new White Star line began to increase

S.S. "Lucania." Dome over Saloon. *(See page 274.)*

the *Lucania* and her sister mark the boldest ance in power and speed that has ever taken place he Atlantic.

slow succession of mprovements in speed, to each new Cunarder and Collins vessel that e on to the scene, brought us to the *Adriatic* the *Persia*. A few years more and there was the

size and to shorten the passage. Since then we have never had long to wait between the advent of the members of the record breaking family, but an advance of some ½ knot, or at most a knot at each stride was considered enough. In their last move the Cunard Co. have felt it desirable to advance some 2 knots in speed, and some fifty per cent. in H.P. No wonder then that

he interest aroused in all classes by the doings of the *Lucania* has been so great. The time is not so long past that in discussing the *Teutonic* and the *City of Paris* men hinted that finality in Atlantic speed had been reached. Yet we have already the record of maiden voyages lowered by fifteen hours at one cut. The next advance will need great consideration, but we cannot think that the doings of the *Lucania* will deaden enterprise elsewhere. They will much more likely stimulate it.

The *Campania* and *Lucania* were built in the same yard as those very successful steamers, the *Umbria* and *Etruria*. These they of course exceed in size and power. Moreover, they are the first of the line to be built with the triple-expansion engine and the twin screw. The duplication of machinery and the immense size of the steamer has led to the rejection of the barque rig, which has distinguished all vessels built for the line since its commencement (though it is a fact that of late years the yards have been stripped of the main masts of their fastest ships). The new rig is that of a simple schooner, and the masts can do no more than support a crow's nest, forward, at a height of some hundred feet, and serve the purpose of signal posts, though of course a little fore and aft canvas might be used for the purpose of steadying the vessel.

The *Lucania* was launched at Fairfield, on the 2nd February of the present year. The hull is of steel, she has a straight stem and an elliptical stern. There are five parallel girders or keels some 15 ft. apart. The main keel plate is 54 in. wide, and is 8 ft. deep under the engines and boilers. This depth is reduced to 4 ft. 6 in. at the ends. The keels are wholly within the fabric of the ship, and the distance between her two skins is arranged according to the depth of the keel, so that there is a space of 8 ft. between them under her vitals, elsewhere only of 4 ft. 6 in. Her principal castings for the stem and stern and the propeller brackets were made by the Steel Co. of Scotland, as were a large proportion of the shell plates. These are usually 26 ft. in length and of a minimum depth of 6 ft. The thickness is from seven-eighths to an inch. The plating is arranged on the overlap principle from the keel to the main deck, the butts above being connected by double butt straps. She has a poop, a top-gallant forecastle, and promenade and shade decks. The latter supports the boats, some twenty in number. The upper, main, lower, and orlop decks are of steel. The maximum length of a compartment is 65 ft. which is scarcely one-tenth of her length. The longitudinal bulkhead between the two engine rooms is pierced by several large doors for convenience of working, and is not intended to be of use in preventing flooding. The bulkheads are arranged in accordance with the results of the parliamentary committee, and are sixteen in number. The hull is 620 ft. over all, 600 ft. between perpendiculars, the moulded depth 43 ft., and depth from shade deck 59 ft. 6 in. The bridge is 60 ft. above the water line. Her tonnage is 12,950 tons gross, 4,945 nett, and cargo capacity 1,620 tons. The engines are two sets of triple-expansion engines, each of the five cylinder type, which was first tried in the old yacht *Lady Torfrida*, built at Fairfield by the present company for its late chairman. Then similar engines were designed for the s.s. *Lahn*, and they were so satisfactory that when the North German Lloyd Co. went to Stettin for their two most recent boats they took the design with them. The H.P. cylinders, of which there are two in each set, are placed upon the two low pressure cylinders, tandem fashion, whilst the one intermediate cylinder of the set is placed between the two. Thus the size of working parts is reduced to a very convenient extent, and at the same time the advantages of the three cranks, set at an angle of 120 deg. to each other, are retained. The stroke of these engines is 69 in., and the H.P. cylinders are 37 in., the intermediate 79 in., and the low pressure 98 in. in diameter. The height of the engines is of course increased by this plan, and the distance from the bottom of the bedplate to the top of the H.P. cylinder is 47 ft. Piston valves are fitted to the H.P. cylinders. The crank shafts are of the built-up interchangeable type made of Vickers' steel, each portion weighing 27 tons. The propeller shafting is 24 in. in diameter. The thrust shafts have 14 rings of the horse-shoe pattern, and are 14 ft. long, weighing 29 tons each. The after end of the propeller shaft has a Dunlop governor fitted. The after framing now claims our attention. The shafting is not carried outboard like that of the *Paris*. The hull is built round the shafting as in the *Teutonic*. There is a hole in the deadwood, too, as in the *Teutonic* and in the *Columbia*, but the blades do not overlap as in the Belfast built ships. The propellers are three bladed, having bosses of Vickers' steel, and blades of manganese bronze. The rudder is wholly below the water line and is made of a single plate of Krupp's steel. It is 1¼ in. thick, and its length and breadth are 22 ft. 6 in. and 11 ft. 6 in. respectively. The steering gear is remarkable. It is the design of Messrs. Brown Bros., and is fixed to the tiller so as to balance the rudder. It moves over with the movement of the rudder, working on a toothed road fixed to the deck of the vessel, and is actuated from the bridge by one of the firm's telemotors. This will be found illustrated and described in the account of the Orient liner *Ophir* (see page 479 of volume xiii.)

The tiller is 17 ft. long and the engine is so arranged as to give, and relieve the strain on the rudder when it is struck by a heavy sea. There is no alternative hand-steering gear fitted but the reserve is an auxiliary steam apparatus fitted forward of the main arrangement. Both these, of course, rely on the tiller, and would be useless should that break. As a precaution against such an accident there are two hydraulic rams which, one on each side, can act upon and so control the rudder head. Messrs. Brown Bros. also supply the steam and hydraulic reversing gear of the main engines. This is of their usual pattern. In conjunction with it is the emergency governor, which works on the "hit and miss" principle, and puts the engines in mid-gear whenever racing ensues, either from the excessive pitching of the vessel or from accident to the machinery, and a certain determined rate of revolution is exceeded.

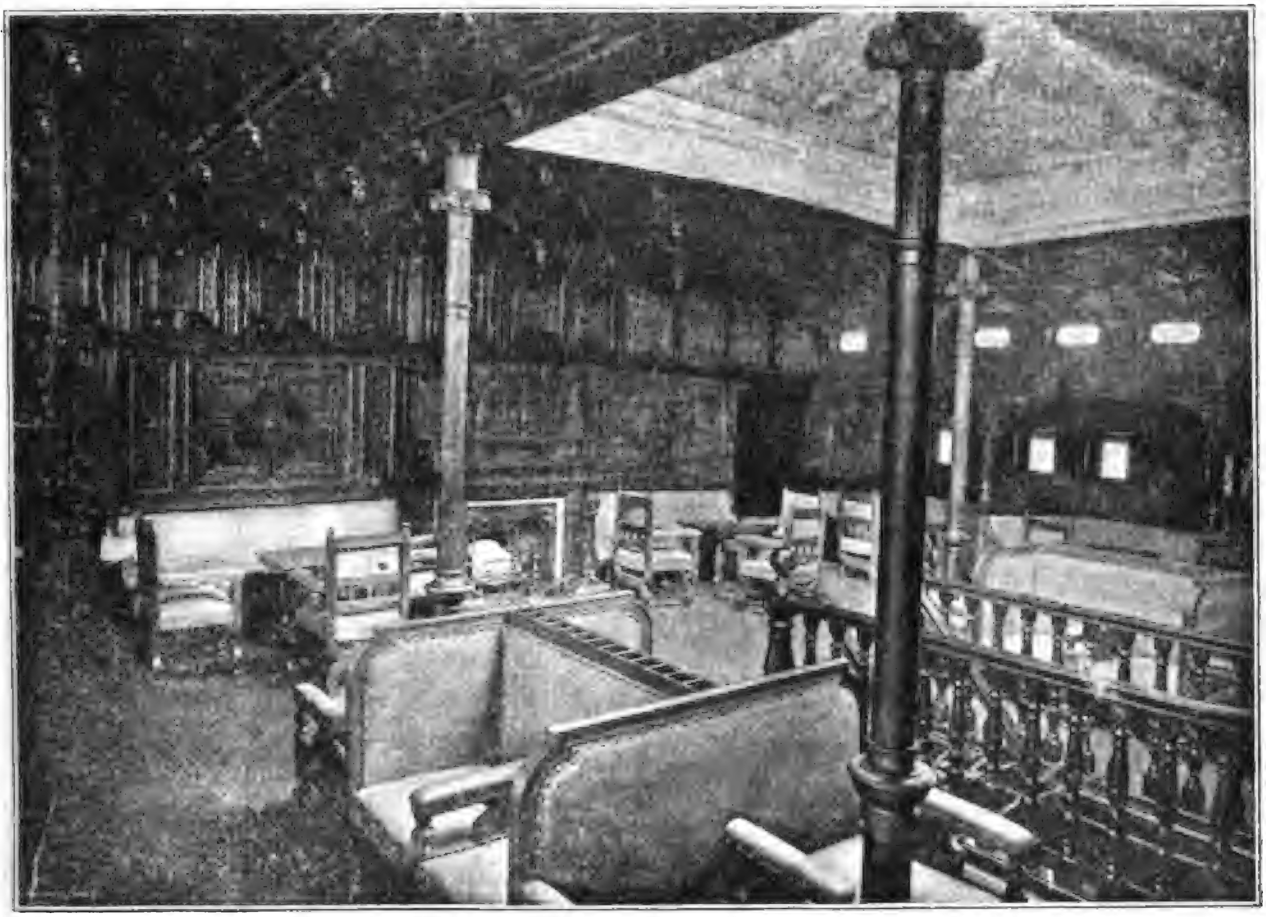
Alongside the bedplate of each set of engines lies its condenser, which, having a division in the middle, affords a separate appliance for each L.P. engine. There are four circulating pumps. These have each their own compound engine by Messrs. W. H. Allen & Co. As a general rule when doing their circulating

work they run at 100 revolutions, but when bilging they are constructed to take high pressure steam in each cylinder and thus run up to 250 revolutions. By this means economy of weight and space is effected. The air-pumps are driven from the L.P. cross heads by levers.

The main boilers are 12 in number. They are of the usual double-ended cylindrical shape. Their length is 17 ft. and diameter 18 ft. They have four furnaces at each end and there are therefore 96 furnaces in the set. They are in two stokeholds, arranged three in a row across the vessel. The groups are separated by a coal bunker 65 ft. long.

engines acting on a single crank for driving the ventilating fans throughout the ship. There are besides the main boilers two auxiliary boilers, one of the same diameter as the main boilers, but single-ended, and only 11 ft. long, having four furnaces, is intended for driving the auxiliary engines, and the other, a donkey boiler, with two furnaces, is 10 ft. in diameter and 10 ft. long. This is for supplying steam when in port.

Messrs. Weir & Sons supply the feed pumps, of which we give an illustration. There are two pairs of main feed pumps, each pair being capable of supplying all the boilers without



S.S. "Lucania." Smoking Room. (*See page* 274.)

The two groups fire into separate funnels, which are necessarily of gigantic size and very far apart. The external diameter of these smokes-tacks is 21 ft. They have an inner casing 19 ft. in diameter. They are 130 ft. apart and rise a similar distance above the floor of the vessel.

The bunker capacity is 3,200 tons, 2,900 tons being consumed on the passage. Her consumption is at the rate of 1·5 lbs. per I.H.P. per hour.

The boilers supply steam at a pressure of 165 lbs. There is no forced draught but there are arrangements for ventilating the stokeholds by artificial means. Messrs. Allen supply 12 of their triple-expansion

being unduly pressed. These pumps have a special valve gear designed to minimise wear and tear, by lessening the jar with which the valve falls into its seat. This is obtained by an arrangement for slowing the piston at the end of its stroke so as to give the valves time to settle quietly. The piston rods are of cold rolled manganese bronze and the water ends of gun metal. Special attention is also paid to the design of the water valves of these pumps. The auxiliary feed pumps are of similar design, but of course on a smaller scale. This firm also supplies a feed heater of their well-known type, which we recently described. (see vol. xv. page 60). In each engine-

room are two Weir evaporators, each of a capacity to supply 30 tons of fresh water a day. Besides these there are hydrokineters, or boiler circulators, and pumps for ballast purposes, as well as Admiralty pattern donkey pumps for supplying fresh water to various parts of the ship. All these are supplied by the same firm.

Besides having an evaporator to make up the waste of the fresh water for boiler feed, it is necessary to keep the whole of the water passing through the boilers free from grease and other impurities. Professor Lewis has shown the danger which attends the presence of grease on furnace crowns, even in small quantities, and also how much heat is wasted by its presence. Recent steamers have therefore been supplied with feed water-filters, and the *Lucania* has had hers from Messrs. Copley, Turner & Co., of Middlesborough. These are of the "Harris" type. The water passes through a double treatment, being first of all passed through a medium which arrests the coarser impurities and then it is further treated so as to render it perfectly pure. The advantage of this type of filter is that it is self-cleansing, and requires no attention on the course of the voyage, although the feed water evaporated in steam raising amounts to 5,000 tons a day, and though this vast quantity passes *through the boilers* and cylinders five times in the 24 *hours.*

The steam pipes are the fruit of much consideration and experiment. Copper is discarded for the purpose and wrought iron substituted. They are no less than 20 in. in diameter.

Messrs. Siemens Bros. are responsible for the electric light installation. There are two sets of generating plant arranged in pairs in separate compartments. The wiring absorbs over forty miles of vulcanised wire. It is on the return wire system. There is a search light of 2,000 candle power, which is capable of being lowered over the stem so as to facilitate docking or anchoring at night. The side and mast heads lights are electric. The four dynamos are of Messrs. Siemens H.B. type, and each can run 700 sixtee candle lights. Each is driven by a separate Crescent engine by the Birmingham firm of G. E. Belliss & Co. making 250 revolutions a minute.

S.S. "Lucania." Drawing Room. (*See page* 274.)

The refrigerating machinery was fitted by the Kilbourn Co. of Liverpool, and is on the ammonia compression system. It is capable of an output of 12 tons of ice per diem. The three chambers have a tota carrying capacity of 3,700 quarters of beef.

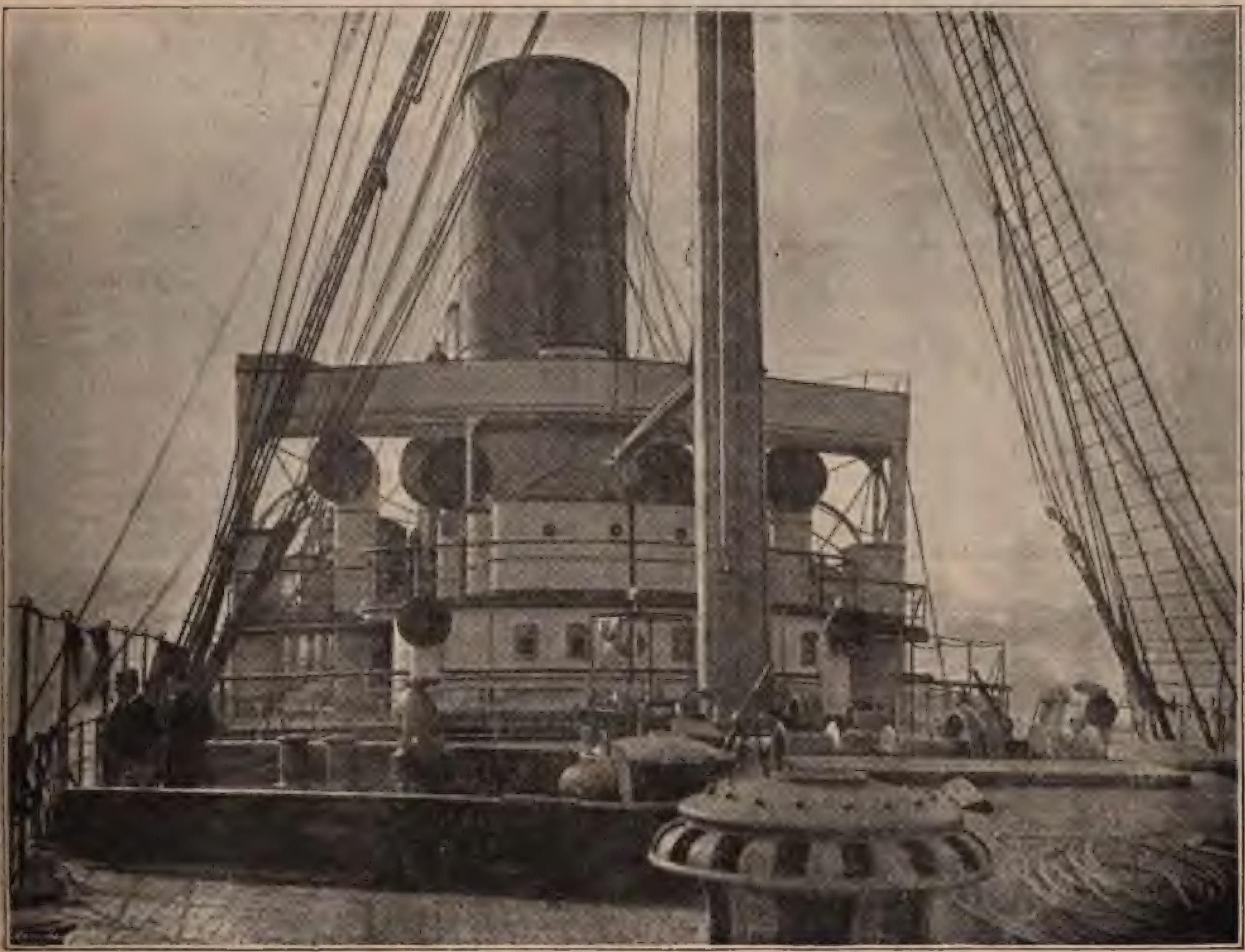
The windlass is by Messrs. Napier Bros., of Gla gow. There are warping capstans fore and aft Messrs. Muir and Caldwell, and the anchors are of ton weight. Both Trotman and stockless anchors provided.

Space hardly allows me to do more than enumerate the appliances and their makers, and for description of the various specialities on board I have to refer readers to previous notices. And yet a great deal remains to be said, for the passenger accommodation still claims our attention.

She is intended to carry 460 saloon, 280 second-class and 700 steerage passengers, and her crew as she left on her maiden voyage, comprised 416 persons. The main saloon situated as in the *Teutonic*, between the funnels and absolutely amidships, will dine all the first-class passengers at once. It is 100 ft. long by 64 ft. broad. There are four long tables in the centre and the sides are separated by screens as in the *Spree* and the *New York*, and here the panels are of glass. The dome rises to a height of 33 ft. and is 24 ft. long by 16 ft. broad. The general height of the saloon is 10 ft. The decoration is ivory and gold, the walls being panelled in mahogany, and, owing to the necessary presence of ventilating shafts and suchlike, the squareness of the room is disguised and a certain degree of privacy attainable. The drawing-room is over the saloon, and looks out into the well through bevelled glass lattice windows. This room is 60 ft long by 30 ft. broad. The feature here is the ingle nook with brass fireplace, and the walls are of satin wood relieved with cedar. Here are the organ and piano. The smoking-room is aft on the promenade deck. It too is a large room, and is furnished in dark oak with hogskin seats. This room also has the attraction of a real fireplace. It is well provided with entrances, having two forward from the state-room corridors, one on each side to and from the promenade deck and a stairway from below.

The library, forward on the same deck, is of horse-shoe shape 29 ft. by 24 ft. The base is lined with book-cases and there is a semicircle of writing-tables under the port-holes. This room has amboyna panels in rosewood styles. In speaking of the drawing-room and smoke-room the lofty appearance should not be forgotten. In the smoke-room, where ventilation is especially desirable, the height in the domed skylight is 15 ft., and elsewhere the height of these rooms has been extended to no less than 12 ft., rising above the rest of the shade deck in a curve like the top of an omnibus.

The staircase is well arranged as regards light, and the majesty of a wide grand staircase, which seems essential to these floating palaces, has been retained, whilst, owing to the introduction of a central balus-



S.S. "Lucania." Looking Aft from Forecastle. (*See page* 274.)

trade, the hapless passenger is not thereby condemned to find himself, when a sudden roll comes, some dangerous distance from a rail to cling to.

Some of the state-rooms are fitted for a single passenger, and the wandering millionaire has his little wants provided for at a price which, though it may make ordinary folk stare, is not at all unreasonable for what he gets. The beds are of Hoskins' triptic patent, and all the upper berths fold up against the bulkheads.

The second-class passengers are located aft the engines. They are given the ample promenade of the poop. Here is their smoke-room, and the saloon has revolving chairs and other conveniences which were unheard of in the first cabin not so many years ago. Their drawing-room has a satin wood cottage piano.

The navigating officers are berthed on the shade deck. There they are removed from all distraction on the part of passengers. The introduction of the shade deck has in recent steamers left the promenade deck free to the saloon traveller. The comforts of the steerage passengers have had full attention and they too have Hoskins' berths.

The crew amounted, as already stated, to over 400 men, including 195 in the engine department, Captain Horatio McKay, of *Umbria* fame, being in command.

The vessel arrived at Greenock after her passage down the Clyde on the last day of July, and after undergoing her preliminary trials went to Birkenhead to be docked and painted preparatory to her full speed trials. She reached Birkenhead on the 11th of August, and on docking it was discovered that in coming down the Clyde she had indented some plates. These were taken off and reshaped. It was thus necessary to omit much of her preliminary work. Nevertheless she had done 25½ statute miles an hour, before docking, and the want of exercise did not spoil her maiden performance. She left Liverpool a few minutes after midnight on the morning of Sunday, the 3rd September, and ran in 10 hours and 47 minutes to Queenstown. That port was left in the afternoon of the same day, and Daunt's Rock, the timing point at one end of the journey, was abeam at 1.43 p.m. She was reported off Fire Island at 11 p.m. on the night of Friday, the 8th, making the passage to Sandy Hook in 5 days 15 hours and 37 minutes. This passage was the best maiden ever made. It knocked the record on the Southampton route made by the *Furst Bismarck* into a cocked hat, and took about 18 hours out of that made by the *Campania*. But in justice to the latter it must be remembered that when she started the winter course of nearly 100 miles greater length was followed. The *Lucania's* daily runs on this remarkable passage (which barely escaped being an absolute "fastest on record") were 460, 490, 498, 516, 533, 284; distance, 2,781 miles; speed, 20·5 knots. The best day, 533 miles, is three miles better than the best done by any vessel except the *Campania*.

It should also be noted that the passage from Liverpool to New York was 6 days 4 hours and 10 minutes. This is an absolute record from Liverpool. The Southampton boats escape the delay at Queenstown for the mails. The record on that route is held by the *Paris*, with a time of six days nine hours and thirty-seven minutes. Even allowing for the greater distance between Southampton and New York over that between Liverpool and the Empire city, we must give the palm to the *Lucania* on her first effort. The future will speak for itself.

We give several illustrations, as follows:—Three views of the Drawing-room, one each of the Dining-room, the Library, the Dome over the Saloon, the Smoking-room, Upper Deck, and looking aft from the forecastle, double-page showing Promenade, Upper, Main and Lower Decks, and a double-page plate of the vessel.

THE LUBRICATION OF MARINE ENGINES.*

By Mr. W. Mc Ross (Member.)

(*Continued from page* 168.)

OTHER bearings in which the gudgeons or pins have not a revolving motion cannot be treated in the same manner. As their frictional motion is equally distant from the vertical points their supply may be considered as correct, but in a great many cases a more automatic system might be adopted; for instance, in beam links and pump levers, in most cases these bearings are not fitted with boxes or cups, but simply have a hole through the top brass, and although we know they require lubrication as much as any other bearings still the supply is invariably left to the few drops given from the oil can, these sometimes reach their destination but oftener do not.

Let us for a little while leave the engine-room and take a look at the tunnel shaft bearings, the principal of which is the thrust block. This a bearing which stands, I may say, by itself, as the friction is on the fore and aft parts instead of top and bottom. Here some interest seems to have been taken in the lubrication supply, as every ring is fitted with its own pipe and syphon, but still I think there is room for greater improvements. Many of you will have seen, and perhaps assisted in, the making of extra receiving cups for the fore and aft ends of the block, connected by an inclining pipe running towards the after cup, so that the oil which is continually working forward fills the cup to the height of the pipe and returns again to the after end, thus keeping the thrust, as it were, running in a bath of oil. This arrangement, all who have had anything to do with, must acknowledge successful, for after two or three hours running, the syphons can be entirely dispensed with and the bearing requires no further supply (if all the connections are tight) for many days. Now although this is a very old arrangement and its success cannot be disputed, I have never seen nor have I ever heard of it being fitted in the first place to a new engine, it being always left to the engineer of the ship to make and attach it himself, although he cannot always have either the time or material to do the necessary work in a proper manner. If it is of so much benefit why cannot the designers see that it is done? They will go to a greater expense in fitting an elaborate water service, but the oil supply must remain in the old way. The other tunnel bearings do not require so much care and attention as the thrust, but even here I think better results would be obtained if they were all fitted with these fore and aft cups and automatically served.

A great many ideas have been recently brought before our notice for lubricating the propeller shaft with oil instead of allowing it to run in water, but I am afraid all are of too complicated a nature to be brought into general practice. If carried out in an easy and satisfactory manner, no one will deny I am sure, that it would be the saving of many a shaft now being ruined through running in salt water.

In bringing this part of my paper to a close, I trust I have clearly expressed myself, perhaps not so plainly as you might wish, but you may agree with me that the defects I have pointed out are not uncommon; and in the marine engine of to-day, brought up as it is to great perfection in design, lubrication should not be looked over or slighted. Regularity is one of its chief features; and let the "greaser" be ever so careful and competent, there must at times be periods in his watch, either through rough weather or extra attention required at some particular part, when this regularity

* Read at a meeting of the Institute of Marine Engineers

cannot be carried out, consequently bad lubrication takes place. Every bearing throughout the engine should be supplied automatically and regularly, and if it can be carried out in small engines (as is now being greatly done), how much easier can it be arranged with the large machines of to-day.

Perhaps at this point a few words may not be out of place in regard to the rule in a good many steamers (not liners, but in what are called outsiders or tramps), of the engineers having to oil the machinery *unaided*. In these times when we are trying to elevate ourselves and those who are to follow us, and to bring a more scientific training into every day use, it seems very wrong that trained engineers should be turned into oil feeders. No engineer in charge of a watch can properly devote his attention to all in his charge, be it ever so small, if his time has to be given up to oiling; something must be neglected. Greasers should be taken from the firemen, good experienced men; for what does a young man fresh from the factory, or class, with "science dripping from his fingers," know of oiling machinery? That what I have referred to is done we know, but it can only be to the owners' ultimate loss. There must be great waste and great loss. If our position requires elevating, this, I think, is one point which requires attention.

Having so far remarked on the various methods of external lubrication, and pointed out what I consider a few of the many defects in its supply, let us look now at internal lubrication, and see if any alteration for good can be made in that direction. Without doubt, in recent years, a great improvement has been brought about here. The old pot impermeator has been entirely superseded by the automatic sight-feed—an arrangement in all its workings simple and effective. With the old style, oil was generally put in twice a day; if it worked, well and good; but generally it did not; now every drop tells a tale, and gives the satisfaction, with the knowledge that all is going well. In the present day, with steam of very high temperatures, little, or perhaps, no internal lubrication is necessary. Many engineers have entirely discarded the supply through the impermeator. But with this I do not agree. Granted that the high pressure steam requires no oil, when this steam reaches the low pressure engine, the temperature has decreased greatly, and here it is where I always find that most mischief takes place. With the large working area of the low pressure piston, some lubrication, I consider, is necessary; very little suffices, but still some is required. If the impermeator, instead of supplying the oil to the steam at its first initial pressure, were so placed that the supply could be given at the time the steam entered the low pressure valve chest, I really think more good would be done, as the lubricating properties of the oil would not be destroyed through coming in contact with steam of high temperature, but would pass at once into the parts requiring it most.

With internal lubrication, we must not overlook that taken in with the piston rods—an amount, I am afraid, greatly overlooked by most engineers in their calculations. Although all given to these rods cannot be absorbed by the steam, still, I consider, at least twenty per cent. is used for that purpose; and on no consideration should any but mineral oils be used. With engines having top end rods, automatic supply is very easy, and I find that the bottom rods can be as easily supplied as the top, and, from my own personal experience, good results have been obtained, not only in the life of the packing, but in the wear of the rods themselves. With a pair of engines of 2,500 H.P. I find that the piston rods (with top ends oiled automatically), and three valve spindles, require one pint per watch of four hours' duration, *i.e.*, six pints in twenty-four hours. Now, if, as I maintain, a fair percentage is absorbed by the steam while the rods are internally working, we have one to two pints used from this source alone for internal lubrication, and the impermeator being fixed to the low pressure valve chest would use ·8 pint. We have, therefore, used two pints in the twenty-four hours. Not a very large

S.S. "Lucania" Drawing Room. (*See page* 274.)

amount, and I do not think it can be very much reduced. The supply required for the high pressure cylinder being taken in by the piston and valve rods, and for the low pressure by the impermeator.

In closing, I hope that however common the ideas thus brought to your notice and however simple the remedies proposed may appear, some good may result from this paper, in such an alteration as is required where a proper system of lubrication has been neglected and where no thought seems to have been given to any improvement, except as to sight-feed impermeators; and since their introduction how many different methods have been brought to our notice, each one of course better than its neighbour—but none I think has reached the root of the evil. Friction I would call the strongest enemy in a marine engine, and if lubrication is the best way to overcome it, the most perfect method should be adopted, let us all try to find it.

The following points have been present to my mind while writing, and it may be well to mention them here.

1. All revolving shafts should be supplied with lubrication, not through the vertical centre, but somewhere at the sides.

2. Every supply outlet to the crank pin should have its own separate supply inlet from the commencement to the finish

3. Each and every bearing, whether small or great, should be supplied automatically, there should be no chance lubrication in connection with a marine engine.

4. No internal lubrication should be used, excepting through the impermeator affixed to the low pressure engine, and also by swabbing piston rods and valve rods with mineral oils alone.

5. Greater thought and more care should be given by designers and builders to the lubricating arrangements, and less to the superfluous water service.

Contract for New Steamer.—The Campbeltown Shipbuilding Co. (Clyde), have contracted to build a steamer for the African trade, to carry over 1,800 tons deadweight, and to steam 10 knots loaded at sea.

THE FLEETS OF THE MAIL LINES.

THE *Lucania* being out of their hands, the Fairfield Yard is sighing for new worlds to conquer, and I should not be surprised to hear a definite announcement of an intention on the part of this great firm to show that they have not exhausted their ideas of Atlantic greyhounds by the construction of the two great Cunarders. If the rumour, which has been floating round for some weeks, has any foundation, we may see the glory return to a line which of recent years has fallen somewhat behind in the Atlantic competition.

My prophesy as to the likelihood of breakdowns in the new paddle boats of the Ostend service was not long in being fulfilled. On the 2nd of September, only one day after the issue of the last number, the *Marie Henriette* was spoken broken down at the back of the Goodwins on her passage to Ostend. The fact is that these very large and fast paddle boats are a mistake. They are extravagant in consumption, their floats are a constant source of trouble, they are exceedingly difficult to design owing to the weight of the paddles and the tendency that these heavy wheels necessarily have to bend the shafting. One of our cleverest designers found this out to his cost not very long ago. Finally the advantage of duplication of machinery given by twin screws is not obtained here. Two reasons are advanced for their retention. One was good in the days of single screws, and is so no longer. It was said that light draught could not be got with a single screw. But for channel purposes the twin screw gives quite light enough draught. The other argument for the retention of the paddle is that passengers prefer it. That was said years ago on the Western Ocean, and for that reason the *Scotia* was built with paddles. But before she was at work Cunard's had screws running in their mail service, and she was soon left alone as the sole remaining example of her type on the Atlantic. Indeed, it was owing to her extravagance that she had to be disposed of when of an age that is usually considered an iron

S.S. "LUCANIA." UPPER DECK. (*See page* 274).

steamer's prime. The great railway companies, who are pre-eminently caterers for passenger traffic, and who generally do not spare capital expense when it appears necessary, are all believers in the twin screw, and we do not hear of objections on the part of their clients. The comfort of passengers is certainly studied; their fancies are just as certainly ignored, and we may be sure that the statement that passengers prefer the paddle is merely an excuse and not the true reason for its retention.

A valued correspondent points out that my remarks on these new boats last month were not altogether fair. He says, "One of the two got through her trials without mishap, she was the *Leopold II.*" Nowadays British shipbuilders and British ship-owners seldom get fair play at the hands of their countrymen as against the foreigner, and I gladly hasten to show that I am not one of the unpatriotic herd who are never so happy as when they are decrying our ships. The *Leopold II.* was the Clyde built vessel, and we shall perhaps see that though Messrs. Denny did not get quite so great a speed on trial out of their ship, they have turned out the vessel which will make the more regular passages, and that is really the chief desideratum.

Some little time ago in these columns I quoted the particulars as published, of the American liners building at Philadelphia. I said that as there stated they seemed more likely to rival the *Umbria* in speed than her later sisters. But in making that statement I forgot the premium for speed which is now the feature in contract-built vessels for foreign owners, and especially for foreign governments. The custom now is to tender at a low price for the vessel, guaranteeing a very moderate speed. A premium calculated on a very liberal scale is added for excess of speed on trial, and it is to this premium that the builder looks for his profit. If the premium is rightly arranged he could afford to build the vessel free. Besides this arrangement adds to his fame as well as gives him credit for a cheapness he may not be entitled to. It is always mentioned in reports of trials that the affair was "very successful, the speed being — knots in excess of the guarantee." The credit of the builder is thereby enhanced. But the true credit depends on the standard on which the guarantee is calculated, and if that is too low the credit is proportionately less. I do not make any suggestions as regards the particular ships in question, but if the new flyers turn out much faster than their guarantee the reason may be looked for here.

The Guion fleet is now reduced to three vessels only. The *Wyoming*, which, as I mentioned at the time, was offered some weeks ago for sale by auction and withdrawn, having now been privately disposed of to a firm of Hartlepool shipbrokers. She sailed away from Liverpool for the last time on the 8th.

Another old liner is in trouble as regards the public yachting business. The *City of Richmond*, which is engaged in the Norway excursion traffic, plying under the Norwegian flag, has failed to satisfy the Board of Trade requirements, and her last cruise was therefore interdicted. She accordingly proceeded to Norway without her passengers.

S.S. "Lucania," Dining Saloon. (*See page* 274.)

I have received a copy of the new Cunard handbook, which is brought out to commemorate the advent of their first twin screw vessels. The volume is very well got up. It contains, of course, the usual information found in such books, but it also contains something more. The pictures of the new ships ready for launching and in frame, reach beyond the mere advertisement. The historical part of the work is also well done, and well illustrated. The pictures of the *Britannia* and of the *Great Western* are of more than passing interest, and have, with permission, been reproduced by one of the weekly budgets. Why this paper in making its selection should have chosen the four-masted Bristol boat and labelled it *Britannia* passes my comprehension. But in shipping, as in other matters, some papers cannot take a correct view under any circumstances. The book is one of permanent interest and for that reason I am glad to see that the deck plans and track chart of the North Atlantic are mounted on cloth so as to be indestructible. The addition of the ocean depth in the track chart is new. Perhaps it is added

in remembrance of the most famous saying of their most famous commander. Capt. Judkins, so the old story goes, was accosted by a lady who was terrified by a gale which his ship had encountered and anxiously enquired of the captain how far they were from land. "Two miles," replied the grim old sea-dog, pointing downwards. With this track chart the lady might have verified the accuracy of his retort if indeed she had spirit left to do so.

The despatch of modern mail steamers is quite in keeping with their speed. It is not so many years ago that a fleet of five vessels had to be maintained at sea to enable a weekly service between Europe and America to be kept up, and this excluding a reserve ship. When the White Star people began to get their boats round in four weeks the wiseacres said that they were cutting into the necessary time in port and that they would pay for their expedition in breakdowns. Now every line gets its ships round in four weeks, and when the American line began to make a fleet of three ships do the work no one took much notice. Yet the *Paris* and *New York* have been successfully running since July with three days only in port at each end of the voyage, and the *Chester* is to be held in reserve. One of the consequences of this expedition, of course, is that vessels are making more voyages in the course of a lifetime than heretofore. It was not till a quarter of a century had passed over the Atlantic Ferry that a vessel succeeded in surviving to accomplish her hundredth round trip. Now we think nothing of that. The *Etruria*, one of the fastest greyhounds afloat to-day, will start on her hundredth trip in October, and the Guion liners, *Wyoming* and *Wisconsin*, whose requiem has just been sung, had both accomplished over two hundred double trips, or say a million and a quarter nautical miles in the twenty-three years of their career.

Friday, the 8th September, saw the completion of two memorable voyages by the two new Cunarders. In the morning *the Campania*, eastward bound, reached Queenstown and completed a passage of just under 5 days, 15 hours, being about 3½ hours better than her previous best. This was itself a considerable improvement on the previous record. Though she had done nothing yet to the westward that could be considered very noteworthy, she by this passage made the eastward record correspond with the westward. Hitherto it had always strangely lagged behind the westward since the advent of 20 knot boats and one began to think that the prevailing westerly winds (which in former days made the westward passages always the slower) had now the contrary effect, and that a westerly breeze against the racer was perhaps an advantage in helping her draught. The same evening the *Lucania* completed her maiden trip and achieved the best first performance ever made. It was about three quarters of a day better than her sisters. This is the fastest maiden passage ever made on either the Queenstown or Southhampton routes and is not very far from being an absolute "fastest on record."

S.S. "Lucania," Drawing Room. (See. page 274)

Some two issues ago I promised to say something more about the Canadian Atlantic record. I find that as the *Labrador* is the champion of the Dominion Line so the *Parisian* makes the fastest passages for the older Allan company. The best passage of the latter was made in 1888, when the *Parisian* left Moville at 5 o'clock on the afternoon of the 17th August, passing Tory Island some three hours and thirty-five minute later. She was off Belle Isle at 1.45 p.m. on the 22nd, thus making the passage "land to land" *i.e.*, from Tory Island to Belle Isle, in what is officially stated at 4 days 17 hours 10 minutes. This is however "apparent time" and we must add 4 hours 22 minutes to this to get the true passage, which is therefore 4 days 21 hours 32 minutes. The distance is about 1,650 miles only so that the speed does not much exceed 14 knots — not a very alarming rate when we see what is done on the longer New York route. It would appear evident that, as the *Labrador* is within disputable distance of this speed, the rivalry of the Canadian trade are not at present worth entering into. One cannot however help

being astonished at the fact that rapid communication with our nearest colony is unattainable when we have a Cape liner doing within a fraction of 18 knots over the nearly 6,000 miles to South Africa. Messrs. Harland & Wolff are however reported as building another new vessel for the Dominion line, and perhaps she will do something to bring back the former glory of the Canadian line.

My readers will remember that the silly division amongst the shareholders of the Union Co. heckled the directors lately for their uncompromising position in regard to the twin screw. Wisdom has not been long in being justified of her children. The feat of the *Scot* in running from Ushant to the Cape and back to Southampton with the H.P. cylinder of one set of engines unworkable will not be forgotten, and now we have the new intermediate steamer *Goth*—one of the three sisters particularly offensive to these objectors—coming from the Cape under a single set. A scrutiny of a few of the salvage awards for towage of vessels whose single shaft had broken at sea, might perhaps finally convince these people that their directors knew more than they did.

The National Co. was a mail and passenger line company once. Their *Helvetia* was rather a favourite ship in the old days with theatrical voyagers, and her then commander, Captain Rogers, left the sea to become more closely allied with his favourite profession. Some interest therefore attaches to the announcement that the old *Helvetia* and her companion, the *Holland*, have just been transferred to the French flag. The *Holland* has attained the mature age of 31, and the *Helvetia* is but two years her junior. The company is now left with ten steamers. Of these two are of the modern type of cargo boat. They are of an aggregate tonnage of 10,460 tons, and the age of this part of the fleet is three years. The remaining eight vessels, comprising some 35,137 tons, are of the patriarchal average age of 27 years. There is obviously still room left for further clearance.

The North German Lloyd people are pre-eminently distinguished for a thorough knowledge of their business. They have just lengthened their China liner *Bayern*. She was previously rather a beamy boat. At the same time we read something of the new West India Co.'s "Royal Mail" boat *Nile*. The wisdom of the latter days is to be found here. Wisdom certainly was conspicuous by its absence in their early history,—and when every one else has discovered that long ships are profitable they build a broad one. Did they ever see that Cunards tried the experiment of great beam in the *Aurania* and have carefully avoided it in their subsequent ships? For the rest the *Nile* is remarkable for nothing.

THE LOADING AND DISCHARGING OF SHIPS.

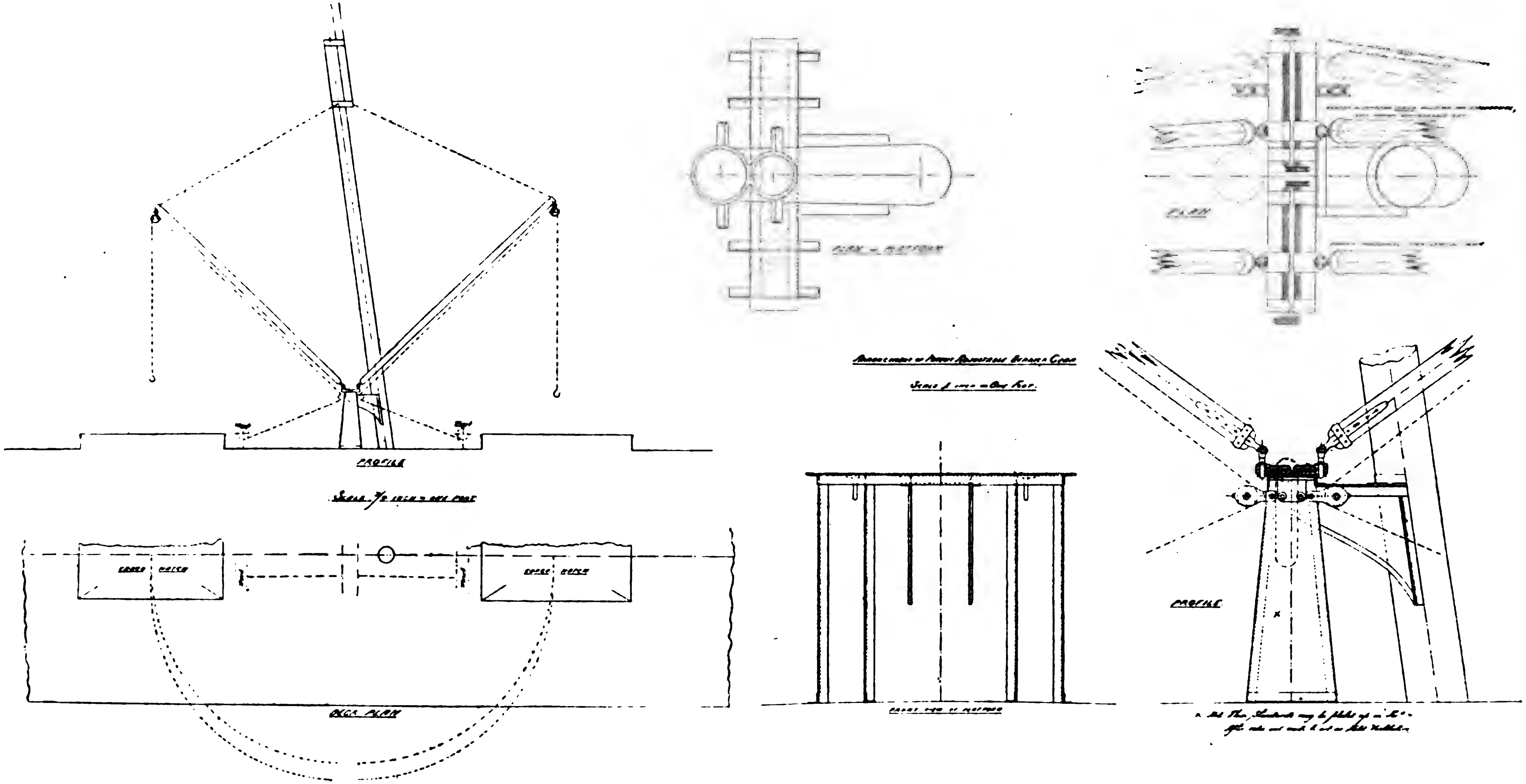
A WORKING exhibition of a new derrick for facilitating the loading and discharging of cargo, was given on Monday, the 18th September, in the Queen's Dock, Glasgow, on the s.s. *Rutland*, a vessel recently launched by Messrs. Barclay, Curle & Co., for Messrs. Donald Currie & Co. This vessel is intended to trade between Liverpool and Hamburg, and in order to facilitate the loading and discharging, has been fitted throughout with what is known as "Tait's Patent Derrick." For those engaged in the practical management of shipping, the matter of working cargo is one of much importance. Hitherto, the main difficulty with derricks has been to get them to swing so as to deposit or lift cargo clear of the ships' side when working on to quay and into barges, an operation which cannot be performed with the present system of derricks without great trouble in dragging them over, and when the ship has a considerable list this is next to impossible. With the new derrick this obstacle has been successfully overcome. The exhibition, as carried through, very clearly showed this, as the vessel was being coaled at the time, causing her to have a very heavy list and also putting her as much as 10 ft. by the stern. Notwithstanding these disadvantages the derrick fully showed its capabilities for dealing with such difficult circumstances. In almost every instance, by present arrangement of the derricks, the cargo requires to be run on skid planks, either to or from the vessel when working on the quay. This also has been overcome, as by using the patent derrick no skids or planks are required, the derrick lifting the cargo right on to the quay. It may here be mentioned that one of the derricks on this vessel is constructed to lift up to 7 tons. The new derrick resembles one of the ordinary type, except that the heel, instead of being stationary, is made to travel along a guide-bar by means of a screw, as shown on illustration. It is in this that the value of the invention lies. By shifting the heel of the derrick to the left of the line of the fair-lead block, which is fixed in the centre as usual, the derrick at once swings to the right, or *vice versa*, the weight of the load supplying the only power required. It is also almost perfectly automatic in coming gently back to its first position the moment the lift is landed. Both in regard to rapidity and safety in dealing with the cargo, the derrick has been working successfully for several months on two vessels, the s.s. *Bernicia* and s.s. *Cumberland*, belonging to Messrs. James Currie & Co. On one of these vessels it has been timed discharging, clear overside, at the rate of three lifts per minute; and it is claimed that given ordinarily favourable conditions and a winch fitted to manipulate a ton weight, the derrick would land easily 100 tons per hour. In the illustrations, which we here give, we have shown the adaptability of the principle where double derricks are required for working hatches both before and abaft mast. At the same time there are many instances in which double derricks are used, whereas by adopting this new arrangement one of these could be dispensed with, without impairing the dispatch, and with the greater saving of steam and labour. This also applies to instances in which owners have been forced to use steam cranes.

The sole manufacturers are Messrs. John Cran & Co., engineers, Leith. Sole agent, Mr. Thomas Niccol, 109, Hope Street, Glasgow.

LAUNCH OF FOUR FRENCH WARSHIPS.

TWO French war vessels have lately been launched, the *d'Iberville* at Saint Nazaire, and the *Lansquenet* at the yard of M. Oriolle at Nantes. According to *Le Yacht*, the *d'Iberville* is a torpedo gun vessel, or "catcher," and is of a type which is the nearest French equivalent to the British *Alarm* type. She is a twin-screw steel ship, measuring 262 ft. 3 in. long by 26 ft. 2 in. broad, and with a mean draught of 11 ft. 1 in. will displace 925 tons. Engines of 5,000 A.H.P. are to give her a speed of 21·5 knots. Over the machinery is a steel deck, but it is only ·6 in. thick. She will carry one 3·9 in. Q.F., three 9-pounder Q.F., and four 1-pounder Q.F. guns, with six torpedo tubes or ejectors, and she is estimated to cost when completed £117,960. She may be regarded as an improved *Sharpshooter*. The *Lansquenet* will be the largest and, for the present, the fastest of the French sea-going torpedo boats. She measures 165 ft. 3 in. long by 15 ft. 7 in. broad, and with a mean draught of 4 ft. 2 in. will displace 138 tons. With twin-screws, and engines indicating 2,800 H.P., she is expected to attain a speed of 26 knots, or about 30 statute miles an hour.

Last month two more French warships were launched—the *Charles Martel* at Brest, and the *Bugeaud* at Cherbourg. The *Charles Martel* is a first-class battleship the largest that has been hitherto built in France. She is 380 ft. 6 in. long and 72 ft. 1 in. broad, and with a draught of 27 ft. 6 in. will dis-



The Loading and Discharging of Ships. (*See page* 285.)

New Pier.—Latest New York mail advices state that the great pier of the American Line at the foot of Vesey Street, North River, will be completed about October 15th. It will after that time be used by the steamers *Paris* and *New York*. The new pier is 720 ft. long and 120 ft. broad. Mr. E. F. Wright, of the American Line, states that the two ships of the line which are being built at Cramp's shipyard in Philadelphia will be completed within eighteen months. These builders will this Fall begin the construction of three other vessels for the American Line, which will exceed the tonnage of the *Paris* by 5,000 tons.

The President of the Marine Section of the Exposition Universelle D'Anvers, 1894—Mr. John P. Best—has issued a circular to British shipowners, soliciting exhibits of models of steamers, sailing ships, and everything appertaining thereto, including machinery and the latest improvements connected with naval architecture, the fitting-out, equipment, and inventory of every class of merchant ships, men-of-war, fishing vessels, yachts, life-boats, and life-saving apparatus, &c., in other words, all that can be produced for a marine exhibition, which would be seen by those interested in maritime matters and thus would become valuable to exhibitors. The Belgian Government have appointed about 50 members to form the Marine Section, who are to exert themselves individually and (or) collectively to render this department as important as possible. This exhibition owes its origin to the port of Antwerp, and is under the patronage and support of His Majesty the King of the Belgians, and the Government.

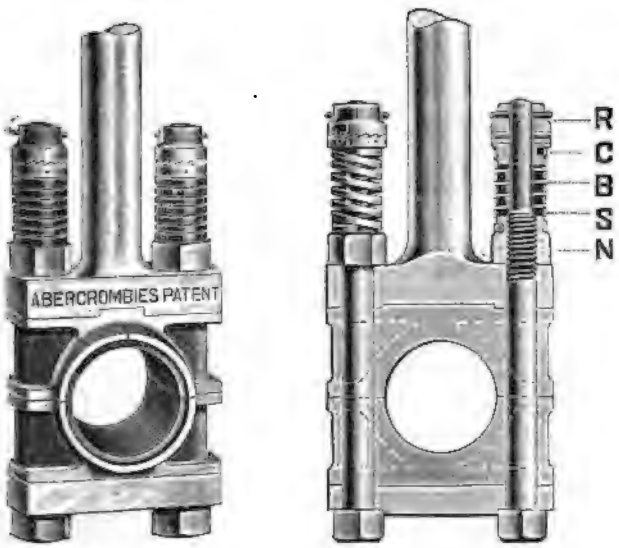
Leith Dock Commission.—At the monthly meeting of the Leith Dock Commission it was stated that the plans of the extension of Newhaven Pier had been approved and instructions given to advertise for tenders. The proposals involve the widening of the East Pier at Newhaven by about 140 ft., at a cost of about £15,000.

place 11,882 tons. Her engines will be of 13,500 I.H.P., and are expected to drive her at an extreme speed of about 17·7 knots. There are two screws. The belt armour, which is of steel, has a *maximum* thickness of 17·7 in.; the turret armour is 14·5 in. thick, and there is a protective deck of 2·7 in. steel. At each extremity is a turret in which is mounted a single 11·8 in. 44-ton gun. On each broadside, sponsoned out so as to permit of fire being delivered ahead or astern, is another turret, containing a single 10·6 in. 34-ton gun. On each broadside, in lighter turrets, are four 5·5 in. Q.F. guns, and in the upper works and tops are distributed four 9-pounders, twelve 3-pounders, and eight smaller Q.F. or machine guns. There is provision for 800 tons of coal. The estimated cost of the vessel is £987,600. The *Bugeaud*, a second-class protected cruiser of the largest type, is 308 ft. long and 42 ft. 6 in. broad, and with a draught of 20 ft. 10 in. will displace 3,722 tons. Her engines, driving twin-screws, will develop 9,000 H.P., and are designed to give an extreme speed of 19·2 knots. The steel deck is 2·4 in. thick. The armament will consist of six 6·2 in. Q.F., four 3·9 in. Q.F., eight 3-pounder Q.F., and twelve 1-pounder machine guns, and six torpedo tubes will be fitted. The bunkers will carry 600 tons of coal. The total estimated cost of the ship is £260,300. She is a sister to the *Chasseloup-Laubat*, which is also being built at Cherbourg, and to the *Friant*, which is being built at Brest.

The name *Jeanne d'Arc* is to be given to one of the 12,000 ton battleships which are about to be laid down for the French Navy. The name was last borne by a 42-gun sailing frigate which was launched in 1847 at Lorient.

A NOVEL TIGHTENING DEVICE FOR JOURNALS.

It is a well-known fact that one of the most difficult parts in an engine to keep oiled and adjusted is the crank pin and its brasses, which arises partly from the fact that in double-acting engines all the strain and shock of the reciprocating parts is transmitted to the crank pin, and partly from the effect of centrifugal action, which gives to the lubricant a tendency to get away from the surfaces from which it is most required.



Any "play" in the brasses tends to further aggravate matters, as it produces violent knocking on the pin, which action displaces the lubricant with the result of a considerable heating of the crank pin.

Any device that will in any way obviate these difficulties is certainly worthy of the attention of engineers, more especially in the cases of high speed engine, or engines, that have to run for long periods without any chance of adjustment without stopping. We have pleasure in bringing to the notice of our readers a simple device that has been invented by a Mr. Abercrombie, by which the brasses of a journal are set up as they wear, so that there is no dead play existent between them and the journal on which they work. This device is illustrated in the adjoining diagrams, which show its construction and mode of application to the connecting rod bolts of an ordinary "big end" of a connecting rod for a marine engine. It will be seen from these illustrations that the device consists of a spiral spring and a ratchet applied to the connecting rod bolts. One end of the spring S is attached to the nut N, which is screwed on to the connecting rod bolt in the usual way, and the other end of the spring is attached to the collar C, which is fitted so as to turn freely on the turned extension of the bolt B, the upper face of this collar being formed as a ratchet. The spring S is put into slight compression, so as to cause the teeth of this ratchet to engage with a similar ratchet formed on the under surface of a second collar R, securely pinned on the end of the bolt; by turning the collar C with a screw key or "tommy" in one direction it is clear that the coils of the spring will be put in torsion, and will thus tend to rotate the nut N on the bolt thread and to draw the two brasses together. By turning the collar C through one or more teeth of the ratchet, any desired grip of the brasses on the pin can be obtained, and as any wear occurs, the nut follows it up automatically, so that the brasses are kept in exact adjustment with one another relative to the crank pin.

The device is capable of many variations to suit all forms, whether solid ends, strap ends, gib and cotter, or wedge and screw adjustments, all of which are protected by the patents.

We understand that the device has been under severe test for twelve months, and that since that period it has been fitted to a number of high speed electric light engines, and in every case has given great satisfaction, particularly on board ship, where the engines have to run for long periods without any chance of adjustment by hand.

The working of the invention is in the hands of Messrs. Browett, Lindley & Co., Limited, London. Works, Patricroft, Manchester.

THE DOUBLE TURRET SHIP "DEVASTATION."

The double turret ship *Devastation*, which has been provided with modern triple-expansion engines by Messrs. Maudsley, Sons, & Field, made a four hours' full power trial under forced draught on Thursday, September 14th, at Portsmouth. The ship was in charge of Commander M'Kinstry, and the steaming was superintended by Mr. Sampson, Mr. Warriner, and Mr. Charles De Grave Sells on behalf of the contractors. The Admiralty was represented by Mr. R. J. Butler, the Steam Reserve by Fleet Engineer Colquhoun, and the Dockyard Steam Department by Mr. W. Rabbidge. The engines were worked for the four hours linked up a couple of inches, and with a greater head of steam than they could use, as it was not deemed necessary to test them beyond the power which they were contracted to develop. They worked satisfactorily throughout, the vacuum being exceptionally high, and the revolutions of both sets of engines uniform. The cards were worked out with the

following results, from which it will be noticed that during only one half-hour did the power indicated fall beyond the contract:—

Boiler Pressure.	Revolutions.		Air Pressure.	Horse Power.
Lbs.	Starboard.	Port.	Inches.	
145	99·5	100·0	·8	7,166
145	99·8	100·9	·9	7,405
140	100·4	100·0	·7	7,029
141	103·3	99 7	1·1	7,266
140	103·3	101·2	1·1	7,514
135	101·5	102·5	1·15	7,172
143	97·5	97·9	1·4	6,990
144	100·7	101·8	1·1	7,175

The above *data* gave the following means:—Steam in boilers, 141·6 lbs.; revolutions, 100·2 and 100·7; vacuum, 28·4 and 28·5 in; I.H.P., starboard 3,727, and 3,847 port; collective I.H.P., 7,214 (contract power, 7,000). The average air-pressure was 1·08 in., the maximum allowed being 2 in.; and the coal consumption, 2·1 lb. per I.H.P. per hour. The speed realized, as measured by patent log, was 14·56 knots. The *Devastation* returned to Portsmouth Harbour on September 15th, on the conclusion of her gunnery and torpedo trials. Commander M'Kinstry was again in command of the ship, and the firing was under the superintendence of Captain Beaumont and Lieutenant Tudor, of the Gunnery Establishment. Captain M'Conochie, of the Ordnance Committee, Captain Foote, Inspector of Warlike Stores, and Mr. Organ, from the Admiralty, being also in attendance, while the manufacturers of the gun mountings, Sir Joseph Whitworth & Co., were represented by Messrs. Matthews & Whinfield. The mountings for the 10-inch 29-ton breachloaders in the turrets differ from all others hitherto supplied to the Navy in the arrangement of the recoil appointments. The new guns have a total length of 342·4 in., a length of bore (including powder-chamber) of 32 in., and a diameter of 43 in. at the breech tapering to 16 in. at the muzzle, and they fire a projectile weighing 500 lbs., with a full charge of 252 lbs. of prismatic brown powder. The muzzle velocity is 2,040 ft. per second, and the muzzle energy 14,430 ft. tons. In the *Devastation* the turret armament is worked entirely by hand, and in consequence the guns can be loaded at any time and in any position. The turrets, however, are rotated by steam, and during her refit a duplicate turning engine has been attached to each turret as a precaution against accident. Four rounds were fired from each of the eight 3-pounder Hotchkiss quick-firing guns. Three rounds were afterwards fired from each of the guns in the fore and after turrets, two independently with reduced and full charges, and the last from each gun simultaneously with full charges. The elevation rose from horizontal to as much as 13 deg. extreme elevation, while the bearings varied from abeam to 10 deg. before to 20 deg. abaft the starboard and port beam respectively. A number of misfires occurred, owing to the use of wire tubes, and in the fore turret there was a little scoring of the brake piston by the glands, which caused some delay. The trials, however, passed off with remarkable success. The recoils from all the guns remained uniform at 36½ in. with full, and at 36¼ in. with reduced charges, while the graphic lines and curves of recoil pressures showed that the action of the bar regulating the influx of water in the brakes was particularly steady. The under-water torpedo gear was subsequently tested by Captain Hall, of the *Vernon*.

THE TRIALS OF THE SPANISH CRUISER "INFANTA MARIA TERESA."

THE new Spanish cruiser *Infanta Maria Teresa*, built at the Astilleros del Nervion, Bilbao, went out from Ferrol on her official natural draught trials on Monday, September 18th. This vessel is the first of three constructed at this new establishment. The draught of the vessel in a preceding trial was 21 ft. 6 in., the displacement being 6,890 tons. The vessel steamed for eight hours at sea, with a heavy swell running in from the Atlantic, and the results were extremely satisfactory, far exceeding expectations, while everything worked splendidly. The fans were kept running merely for efficiently ventilating the stokehold, and the pressure recorded by water gauge was $\frac{3}{16}$ in. Of course there was no difficulty with tubes. A plentiful supply of steam was maintained at a mean pressure of 145 lb. per square inch. The mean power of the half-hourly records of the engines was for the starboard set 4,686 I.H.P. at 105 revolutions, and for the port engine 4,872 I.H.P. at 106 revolutions, a total of 9,558 I.H.P. The vacuum was 27½ in. The method taken to arrive at the speed of the ship was as follows: The vessel ran over the measured mile four times before and four times after the run at sea, during which runs the Naval Commissioner from Madrid ascertained the number of revolutions corresponding to one nautical mile. The average number of the eight runs on the measured mile was adopted by the means of ascertaining the speed of the vessel in nautical miles during the trial at sea. The speed worked out at 18·48 knots. The highest speed record was at the rate of 18·8 knots. The guarantee was 18 knots, so that the result is most satisfactory. It may be added that if the mean speed attained by the vessel at the trials had been less than 18 knots, without falling below 17½ knots, the vessel would have been accepted only on payment by the builders of 80,000 pesetas for each complete tenth part of a mile per hour that had not been attained. The vessel is to proceed on her forced draught trials forthwith, when a speed of 20 knots is to be maintained for four hours at sea.

The *Infanta Maria Teresa* is built entirely of Siemens-Martin steel, is 340 ft. long between perpendiculars, and 364 ft. over all, with a breadth of 65 ft., and a depth of 38 ft., displacing 7,000 tons on a mean draught of 21 ft. 6 in. She has the usual ram bow, and carries two masts, each having a military top and signalling yard. The masts and funnels have just enough rake to give a very smart appearance. For 315 ft. amidships she has an armour belt 5 ft. 6 in. broad, backed by 6-in. teak. The plates, which were supplied by Messrs. Cammell & Co., are 12 in. thick, secured by 3½-in. bolts. She has the usual cellular double bottom, and has eleven transverse watertight bulkheads, the bunkers being arranged in the usual manner to afford the machinery as much protection as possible. She carries in all twelve boats, including a 60-ft. 17-knot vedette boat, four large sailing pinnaces, a 30-ft. gig, 28-ft. whaleboat, two dingies, a 25-ft. canoe, and two 30-ft. 8-knot steam launches, the machinery of the latter being constructed in the Astilleros. Forward she has a very powerful capstan, and a large warping winch aft, and is fitted with Muir & Caldwell's patent steam steering gear. The total bunker capacity is over 45,000 cubic feet, and 490 tons of fresh water are carried under the boilers. Her principal ground tackle consists of two 90-cwt. and two 80-cwt. ordinary anchors, two 80-cwt. stockless, and two kedge anchors of 14 cwt. and 8 cwt respectively. The pumping arrangements and ventilation of the ship have been well looked after, and throughout the whole ship a proper and complete system of the voice-pipe arrangement has been instituted. Between the bridges, conning tower, steering gear, and engine rooms, as also between the engine and boiler rooms, &c., Messrs. Chadburn's patent telegraph gear has been fitted. Mr. James Clark, formerly of the Barrow Shipbuilding Co., who went to Bilbao at the commencement of the works, succeeded Mr. J. P. Wilson as manager of the shipbuilding department, and the short time in which the first cruiser was built speaks well for the management.

The ship has in all eight torpedo tubes, and the principal armament is as follows:—Two 28-centimetre guns (one forward and one aft) mounted in barbette turrets, ten 14-centimetre guns, two 7-centimetre guns, eight 57-millimetre Nordenfeldts, two 11-millimetre Nordenfeldts, and eight Hotchkiss. The forgings for these were brought from England, but they were turned and finished in the Astilleros Gun Factory, all the employés of which are Spaniards. This department is managed by Colonel Albairan, who has had considerable experiences in the Government gun factories, and who has satisfactorily finished the work entrusted to him, which excels by far similar work produced in the Spanish Royal Dockyards.

The propelling engines are of the vertical triple-expansion surface-condensing direct-acting type, driving twin-screws, and are designed to develop collectively about 13,500 I.H.P. with forced draught, the contract speed for which is 20 knots. The dimensions of cylinders are:—High pressure, 42 in.; intermediate pressure, 62 in.; and low pressure 92 in., by 46 in. stroke. The cylinders are fitted throughout with Whitworth's fluid compressed steel liners. In both engine and boiler-rooms there is plenty of clear space. The cylinders, cylinder covers, pistons, and steam chest doors are all of cast steel. The high-pressure cylinders are fitted with piston valves, and the inter-

mediate pressure and low-pressure with valves of the ordinary flat-faced ported type. The piston-rods, which are 7¾ in. in diameter, are of Siemens-Martin steel, as are also all the forgings. The high-pressure rods are fitted with Beldam's patent packing, the packing for the intermediate pressure and low-pressure having been supplied by the Combination Metallic Packing Co. The thrust blocks and collars are of cast steel, the latter being of the horseshoe shape and lined with "Magnolia" metal. The main surface condensers, which are 10 ft. 8 in. long, are made entirely of brass, having a total surface of 14,600 square feet. Each condenser carries over 5,000 brass tubes 10 ft. 8 in. by ⅝ in. in diameter. The crank shafts, which were supplied by Messrs. Cammell & Co., are of the ordinary three-throw type, being made of steel, the external diameter being 16½ in. The reversing gear is of the ordinary all-round type, both hand and steam gear being provided. In each engine-room there is a 100-gallon Kirkaldy's distiller, each with a circulating pump, as also an evaporator on Weir's system with its 4-in. cylinder feed pump. There are four ash-hoisting engines, having two 4½-in. cylinders by 5½-in. stroke, and efficient means have been provided for handling the ash-buckets under forced draught. The engines for working the ammunition hoists are placed one forward and one aft, both working double hoists. The ammunition hoists themselves are provided with safety gear, to prevent the charges falling and causing an explosion on board, in case of the rope suspending them being shot away. The main steam pipes are 18 in. in diameter, and are all of copper, the sheets having been brazed and wrought up in the coppersmithy.

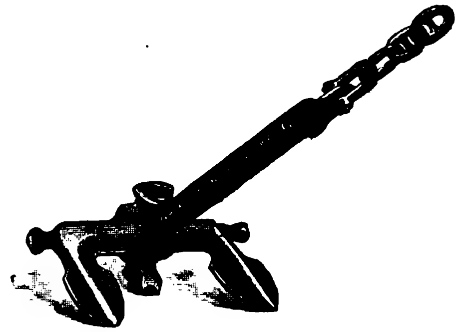
Forward of the mainmast a boat-hoisting engine has been fitted, having 9-in. cylinders, and capable of lifting 18 tons, the mast being provided with a suitable boom for raising and lowering the heaviest boats. Air-compressing machinery, supplied by Schwartzkopff, for charging the torpedo tubes and torpedoes, has also been fitted for working up to 1,500 lb. pressure. The exhaust steam from the auxiliary machinery is carried into two auxiliary condensers 8 ft. long—one in each engine-room—each condenser being provided with its own air and circulating pumps, which are worked by entirely independent engines. These condensers, like the main, are made entirely of brass, and each contains about 700 tubes.

In all there are over fifty separate and auxiliary engines, the whole of which, excepting the windlass, steering gear, distillers, and vedette boat machinery, have been constructed in the Astilleros. In a situation convenient to the engine-room an engineers' workshop has been erected, and fully provided with all the requisite machines, tools, and grindstones. The two propellers are three-bladed and cast of Stone's patent No. 3 bronze, the bosses and tail-pieces being of gun-metal, and the bades fixed by bolts in the usual manner. The propellers have a diameter of 16 ft. 5 in. and 20 ft. 6 in. pitch, the expanded surface being 73 square feet. For each engine there are four lengths of straight shafting, which was supplied rough turned and finished in the Astilleros. The diameter of the intermediate shafting is 15¼ in., that of propeller shafting being 15⅝ in.

Steam is supplied by four double-ended boilers 16 ft. 3 in. in diameter, and two single-ended boilers 15 ft. 3 in. long by 10 ft. 6 in. in diameter, and working at a pressure of 150 lb. per square inch, the test pressure being 250. Following out the usual plan, to provide greater safety, the boilers are placed in two separate compartments, the bunkers being run along each side in the usual way. There are two funnels, 9 ft. in diameter, the height from dead-plate to top of funnel being 69 ft. There are in all 40 Purves' patent boiler flues 6 ft. 6 in. long, and having a mean diameter of 3 ft. 3 in. The double-ended boiler tubes are 6 ft. 3 in. by 2½ in., the single-ended boiler tubes being 6 ft. 9 in. by 2½ in., the length between tube plates being for double-ended 6 ft. 3 in., for single-ended 6 ft. 9 in. The grate surface is 845 square feet; tube surface 22,270 square feet; heating surface, 25,920 square feet. For supplying steam to the electric light and steering gear engines, there are two auxiliary boilers on the protective deck forward, each 8 ft. 10 in. long by 7 ft. 9 in. in diameter, with a 3½ in. Worthington system pump provided. The usual stokehold arrangements for running under forced draught have been fitted, there being nine fans, having a diameter of 5 ft. 6 in. The designing and construction of the engines, boilers, and auxiliary machinery, as well as the construction and equipment of the engine works, have been carried out by Mr. James McKechnie, who has been assisted by Mr. James Brown, formerly of the Clydebank engineering staff.

TYZACK'S TRIPLE GRIP ANCHOR.

WE have pleasure in placing before our readers the above illustration of the latest type of stockless



anchor introduced by Mr. George Tyzack, of South Shields. The anchor is known as "Tyzack's Patent Triple Grip," and an article in reference to it appeared in our September issue, page 246.

GERMAN SHIPBUILDING AND GOVERNMENT SUPERVISION.

(*From our own Correspondent.*)

TOWARDS the end of August the German shipbuilders and owners were astonished at the publication of a circular proposing to place the shipbuilding industry under the yoke of Government control. The circular was sent to Freiherrn von Berlepsch, Minister of Commerce and Industry, and from him again to the various commercial boards for approval. The letter, which is dated the 24th July, 1893, was published in the *Ostsee Zeitung*, after being received by the Stettin Board of Commerce, and reads as follows :—

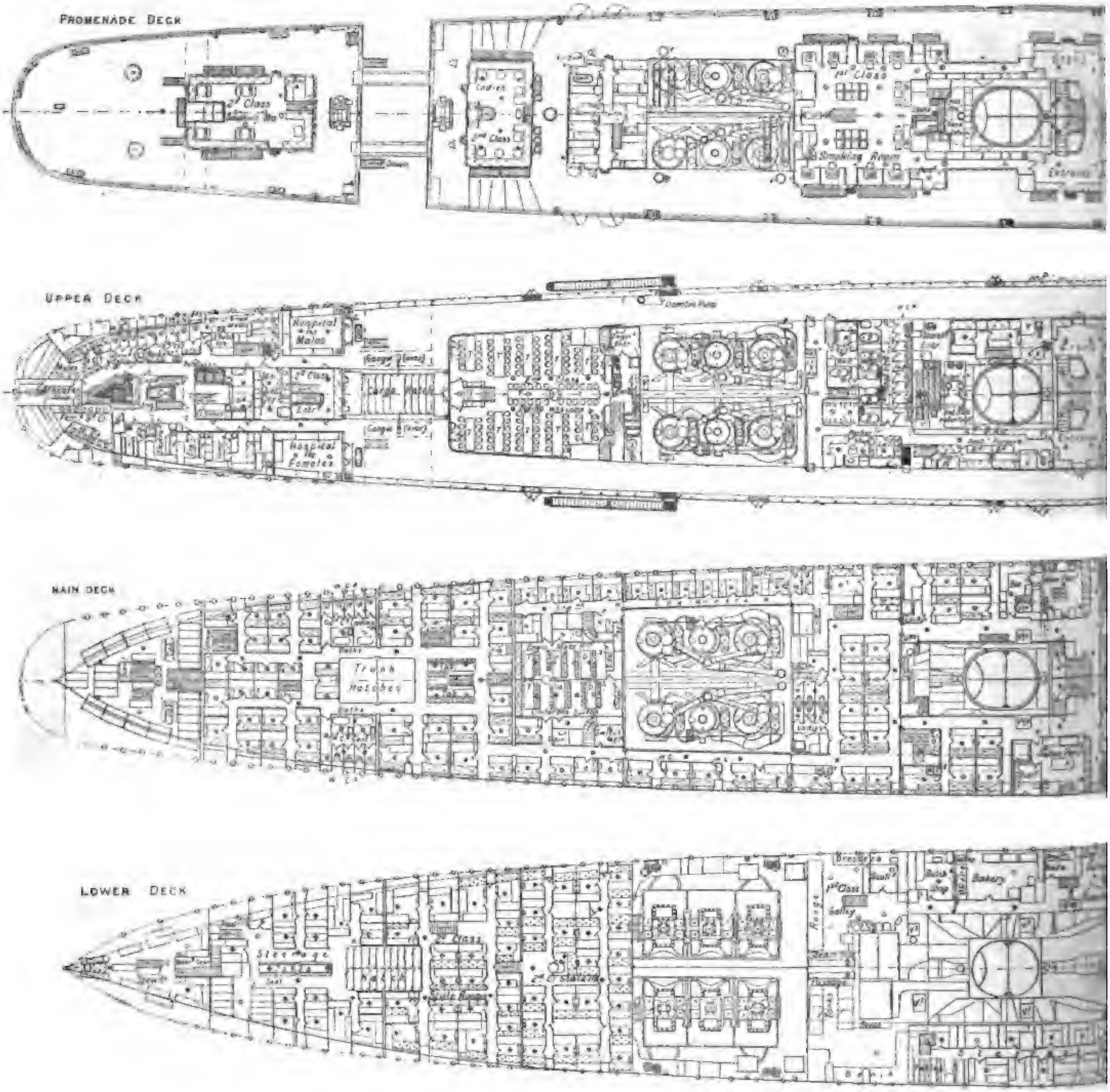
"At present the control of the building conditions of sea-going ships (the examination of the plans, superintending the building, and the control over the seaworthiness) is almost entirely in the hands of the classifying societies. It is true, there is a Government control over the equipment of emigrant ships and some passenger vessels before starting on each voyage. As a rule, however, the examining plans, testing materials, and construction are beyond the power of the Government, which is supplanted by the various registries.

"On the ground of the state of affairs just mentioned, the question is raised, if it would not be advancing the safety of the shipping of the country without injuring the use of the registries, were the building of seagoing vessels also controlled by Government officials? It is admitted that the existence of the registries has considerably reduced the responsibility of the shipbuilder, who is bound to work according to their rules. Those companies and their surveyors have generally to decide what scantlings and strength ships are to have.

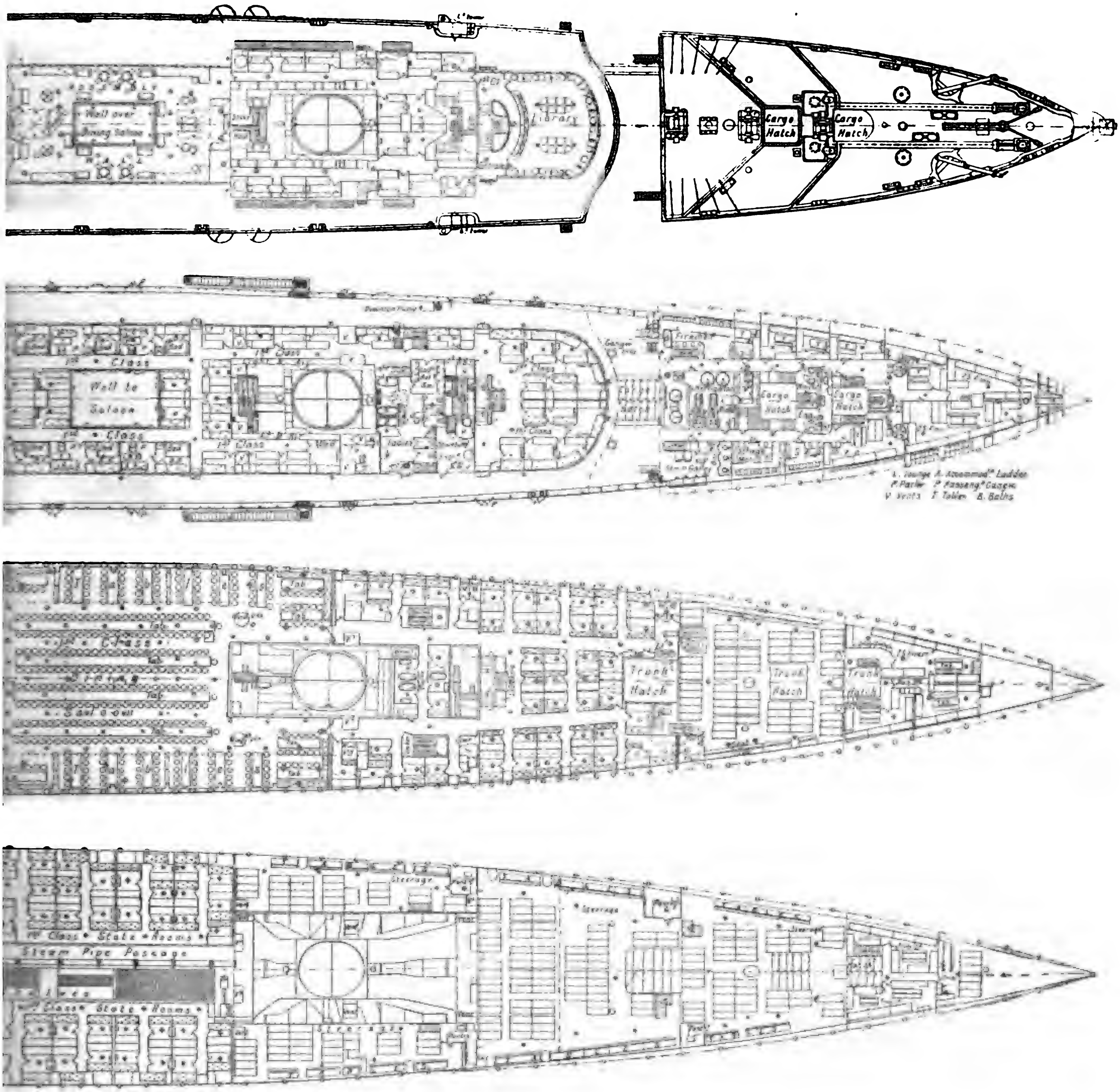
"The opposition between the registries causes a danger that, for the sake of gaining a commercial advantage, the said companies might reduce their technical requirements below the proper factor of safety. This explains why many of the large transatlantic companies, for whose vessels strength is an advantage, require scantlings much in excess of those specified for their class. In addition, in Germany the classification of ships is to great extent in the hands of foreign companies, over which the Government has no control.

"It seems desirable to take the responsibility for the quality of our vessels from the registries and place it more on the shipbuilder. For this purpose it would be advisable to introduce a Government Naval Architectural Department to watch the construction of all merchant ships sailing under the German flag, provided the laws respecting accidents at sea were not so altered as to make the shipbuilder as responsible as the captain or engineer in charge. Such a necessity is greater in the case of a passenger than a cargo vessel.

"Although it would at present be sufficient when the builder



THE CUNARD TWIN-SCREW STEAMER "LUCANIA," BUILT AND ENGINED BY



FAIRFIELD SHIPBUILDING AND ENGINEERING CO., LD., FAIRFIELD.

or owner supplied the proposed Government Department with plans and a note of all moments which influence the seaworthiness of new vessels, still it would be necessary in the case of passenger ships not only to have the plans approved, but also to have the vessel inspected during construction and after completion, periodically, by a government surveyor.

"I cannot disown the difficulties and trouble which would follow the control of the hitherto so thoroughly free industry, especially for those connected with it. At a time, however, when the greatest seafaring nation, Great Britain, is, for the protection of life at sea, taking steps towards extending the Plimsoll's Merchant Shipping Act, of 1876, which are felt even by foreign owners, Germany cannot refuse to make arrangements for the safety of her ships. In how far the example of Great Britain is to be followed independent of the above regulations can be left to further discussion. In the meantime, it is of importance to me to hear the opinion of the honourable provincial government if, and to what extent, the above regulations are necessary and practicable. Reserving the further discussion of the matter for a select committee, I have the honour, most noble sir, of humbly requesting an answer."

Since the publication of the above letter almost all the newspaper articles have been strongly opposed to the project, and it is to be hoped that the Government, in the interest of the German shipping, will take no further steps in the matter. Should such a control be put into force, the result would undoubtedly be that a great number of the German merchant vessels would be sailed under foreign flags. The merchant navy would quickly decrease, and of course the shipbuilding industry be reduced to a minimum.

The purpose of the Government is, however, not so much a restriction to shipbuilding as to the registries, probably arising from the fact that a large proportion of the business is in the hands of English Lloyd's Registry and Bureau Veritas, both foreign companies. It may also be said that although the surveyors, in whose hands the greater part of the responsibility lies, are, especially in the important districts, excellent; still in the case of German Lloyd there is room for improvement. In going over the list of surveyors and agents it is striking how few engineers or shipbuilders are among them. There are, for instance, in the above-mentioned list, about 113 captains, 115 agents, and 102 engineers, shipbuilders and surveyors (so called Besichtiger) whose profession is not definitely stated. Now, it may be asked if the Government is not to some extent justified in taking steps to control matters, when an old captain, however good and clever a man, is often expected to direct and control the work of a learned and practical shipbuilder. It is occasionally the case that a captain who was brought up to sail wooden ships is expected to say how and to what extent an iron or steel ship can best be strengthened.

Still, in spite of all the faults that can be found, there is hardly anyone connected with the German shipping trade who would support the Government proposal. The merchant fleet of the "Fatherland" has greatly increased of late years, and it would be a pity were a step taken which would add to the burden of laws at present in force.

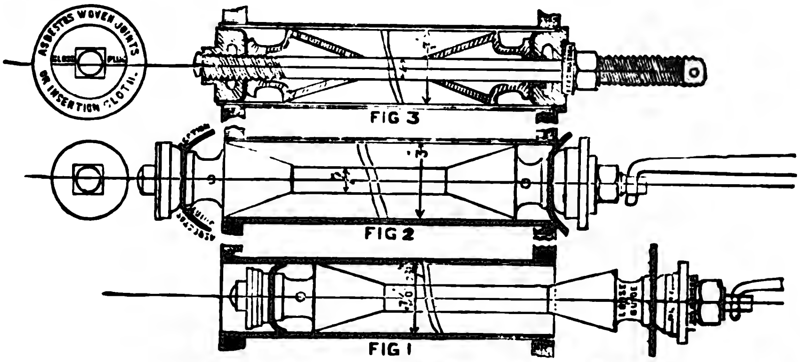


FIG 3

FIG 2

FIG 1

WATSON'S PATENT BOILER TUBE STOPPER AND TUBE EXPANDER.

We illustrate, in the adjoining diagrams, a new form of tube stopper, invented by Mr. Watson, of Liverpool; also a tube expander on the same principle as the stopper. The tube stopper consists essentially of a central tension rod, two guides, two plugs, and two flexible washers. In the illustrations, Fig. 1 shows the stopper being passed through the tube; Fig. 2 shows it after it has passed through ready for screwing up to make the joint, while Fig. 3 shows the stopper screwed up into position. Fig. 4 shows the stopper arranged with a central tube instead of a rod. The central tension tube or rod requires to be 6 in. longer than any given length of boiler tube and to be screwed 6 in. at the front and 3 in. at the back end. The back guide is passed easy on to the rod at the point, and screwed to fit the rod at the head to hold it in position.

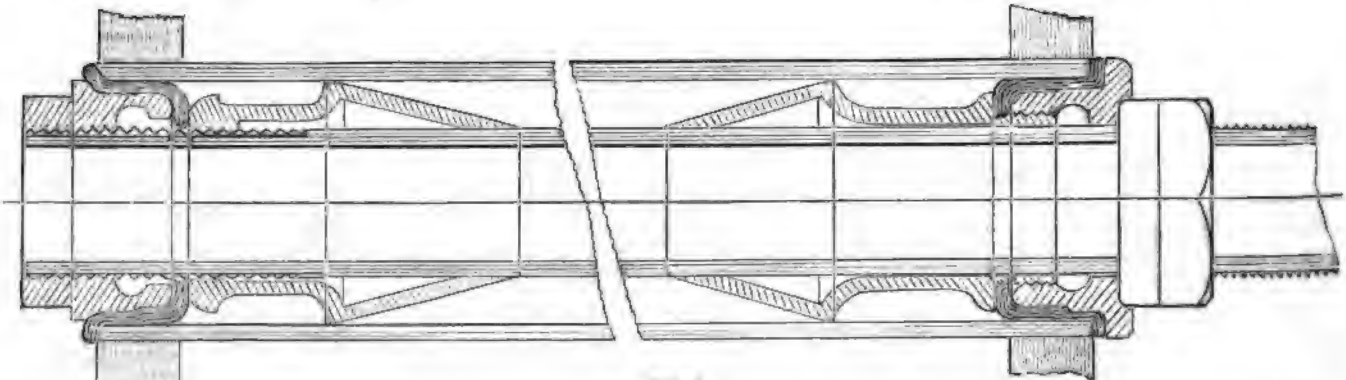
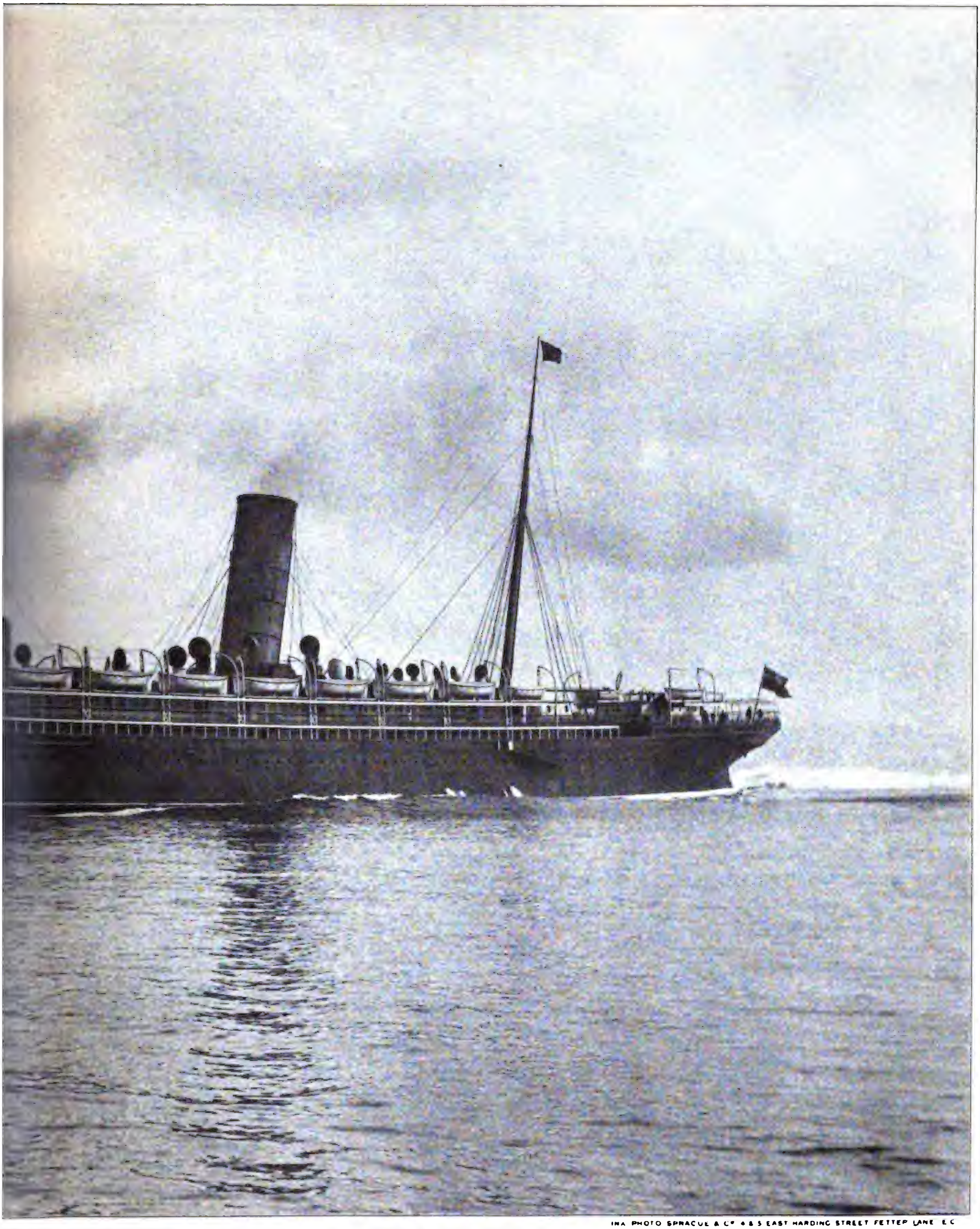


FIG. 4.

A flat disc of insertion cloth or woven asbestos of proper diameter and thickness is passed tightly over

THE CUNARD STEAM-SHIP CO.'S ROY

Built and Engined


INK PHOTO SPRAGUE & Co 4 & 5 EAST HARDING STREET FETTER LANE E.C.

MAIL TWIN-SCREW STEAMER "LUCANIA."

the thread and the end plug screwed on hard, by a square arranged on the outer part of the plug, thus holding the flexible jointing disc between the plug and guide. The front plug and guide with jointing disc held between them, are passed easy over the front end of the rod or tube; a lead washer and nut completes the device ready to pass through the tube. In the passage of the stopper through the tube, the back-jointing disc becomes folded round the head of the guide. When the plug and head of guide have passed through the tube, the jointing disc spreads out and is drawn in by the plug into the form of a cup leather and held fast by the projection on the end of the plug.

The front joint is pressed close over the mouth of the tube to protect the operator while screwing up the stopper.

In Figs. 5 and 6, the expander is shown, the former figure illustrating an open expanding plug with its springs arranged upon a central tube, while the latter figure shows them arranged upon a rod. This device is designed to expand the tube into its place, when sprung or leaking by the action of the force draught. To expand the tubes into the back tube-plate when leaking, the stopper arrangement is used. The expander is only different from the stopper in that the flexible woven jointing disc of the stopper is replaced by a metallic spring disc, having a series of arms or liners. The method of using the device is as follows:—The open plug with the metallic springs or liners is pushed through the tube on the head of the guide until the plug and guide have passed through and out of the tube a short distance, when the springs spread out, whereupon the plug is drawn back so that the springs are drawn in between the plug and tube, the whole being then screwed hard home. The plugs being slightly tapered, the flexible liners act like so many fine wedges to expand the tubes. The parts of the stopper arrangement are then screwed out of the back plug and withdrawn, leaving the plug fixed in line with the back tube-plate. A dozen of these plugs can be put in position in a very short space of time without drawing fires or letting down the steam pressure. When the smoke-box doors are closed, the plug becomes heated and consequently expands and becomes more firmly secured. A further point of utility is that the plugs act as distributors or retarders. These devices are being put on the market by Messrs. Watson & Hudson, of 9A, City Buildings, Old Hall Street, Liverpool.

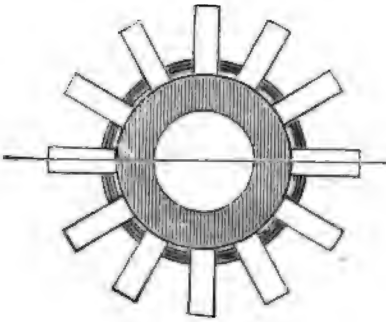


FIG. 5.

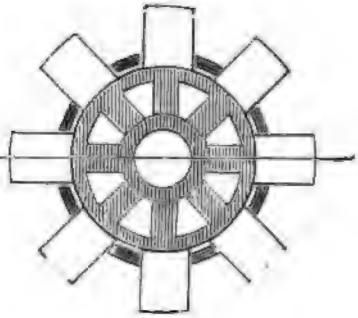


FIG. 6.

THE LARGEST CARGO STEAMER IN THE WORLD.

THE construction in recent years for the Atlantic passenger trade of swift high-powered steamers possessing necessarily small cargo carrying capacity, has given rise to the building of steamers for the sole conveyance of cargo and live stock, and the number of these steamers employed between England and the northern ports of the United States is steadily on the increase.

The White Star Line has formed an entire fleet, consisting of the highest class of steamers, for their cargo and live stock service between Liverpool and New York, the majority of whic are fitted with twin-screws. They sail from Liverpool every Friday, and New York every Tuesday. The company has been remarkably successful in the conveyance of live stock. During the current year their steamers have brought over from New York to Liverpool 20,673 head of cattle, out of which number they have only lost 13, showing the extremely small percentage of ·06 of one per cent., in addition they have carried without loss 163 horses from the United States.

A new twin-screw steamer, which is by far the largest freight steamer in the world, was launched on Saturday, September 23rd, from the yard of Messrs. Harland & Wolff, at Queen's Island, Belfast, and is intended on completion to take her place in the White Star cargo fleet. This vessel, which is named the *Cevic*, signifying her relationship to the *Bovic*, *Tauric*, and *Nomadic*, is of the following dimensions, viz., length 500 ft., breadth 60 ft., depth 38 ft., estimated registered tonnage 8,315 gross, 5,335 net, total capacity of holds 14,089 tons. She will be fitted for the accommodation of 800 head of cattle on the upper and bridge decks, and will in addition have permanent stalls for 20 horses in the centre of the upper deck.

The *Cevic* will be fitted with two complete sets of triple expansion engines driving separate propellers, so that the chances of total breakdown will be reduced to a minimum, and every improvement that can be devised in respect of ventilation, fresh water supply, &c., conducive to the safe carriage of horses and live stock will be provided. A ship of this large size, and so completely equipped as the *Cevic* should form an invaluable Admiralty transport for horses and material.

FIRST-CLASS TORPEDO GUNBOAT "LEDA."

THE official full power trial under forced draught of the first-class torpedo gunboat *Leda* was successfully carried out on the 11th ult. off Sheerness, the dockyard being represented by Mr. Pattison, while Mr. Samuel Rock represented the Admiralty, and Mr. J. P. Hall the engineer contractors. This vessel is the third of this class engined by Messrs. John Penn & Sons, Limited, and built at Sheerness Dockyard from the designs of Mr. W. H. White, C.B., director of Naval Construction, and is one of the ships included in the Naval Defence Act.

The first of these vessels, the *Circe*, underwent her trials in March last, and the second, the *Alarm*, in May last, both having considerably exceeded the contract power.

On the forced draught full-power trial of three hours, the machinery is required to develop and maintain 3,500 I.H.P. with not more than 3 in. of air pressure in the stokeholds, this was satisfactorily exceeded on the trial of the *Leda*, which obtained a mean of 3,601 H.P., with an average steam pressure in boilers of 148 lbs., vacuum 27·5, revolutions 246. The mean air pressure in the stokeholds was 2·21, and the speed of the vessel was 18·3 knots.

The furnaces of the boilers, which are of the marine locomotive type, are corrugated on the sides and top on the principle of Mr. F. W. Webb, manager of the London and North Western Railway Co., and the fire-box ends of the tubes were fitted with ferrules on the Admiralty plan.

On examination after the trials the boilers were found to have sustained no ill effects from the application of forced draught.

The following details show the powers for the six half hours as taken:—

Half hours.	Indicated Horse Power.		Collective I.H.P.
	Starboard.	Port.	
1·	1783·9	1763·8	3547·7
2·	1771·8	1811·2	3583·0
3·	1777·6	1784·4	3562·0
4·	1937·1	1854·5	3791·6
5·	1801·9	1767·1	3569·0
6·	1784·5	1769·6	3554·1
			21607·4

Mean I.H.P. for the three hours 3,601·2.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our own Correspondent.)

The Navy Estimates.

ALL the money asked for by the Government for the maintenance of the Royal Navy has been voted after some considerable discussion, wide in range but barren in result. It is sometimes asked whether a vote in estimates has ever been reduced or augmented, and the answer surely must be in the negative, for such a thing has never happened in the memory of living man. The nearest approach to such a state of affairs in late years occurred in 1884, when, during an autumn session, Lords Northbrook and Brassey brought forward, in response to a national demand, a supplementary estimate for strengthening the Navy by several battleships and cruisers. It was this vote, passed in the last Gladstone administration, that gave to the fleet the *Trafalgar* and the *Nile*, the belted cruisers, and the scouts of the *Archer* type. There are not wanting indications that a similar measure may have to be taken this year, for Lord George Hamilton insists that if the standard of naval strength which has been declared necessary for the Empire's safety is to be maintained, more money must be taken and more ships begun. No steps have yet been considered needful to replace the *Victoria*, and so far as the ships of this year's programme are concerned they only exist at present on paper. There is a strong and growing feeling in the country that unless some effort of a determined and persistant nature is made soon, we shall, in two or three years, find our supremacy at sea unquestionably endangered.

Battleship Stability.

The question of the proper construction and adequate stability of several of our battleships, which was again raised by Sir Edward Reed during the discussion on the Estimates, is one of great moment, and yet has not attracted very wide attention. This is probably owing to the fact that as regards this subject Sir Edward Reed's views are so well known as to discount whatever he has to say on the matter. It has therefore not been noticed to any great extent that the charge now brought against these special class of ships is a new one in a certain sense, and involves much more than that which was formerly made by this eminent authority. When Sir Nathaniel Barnaby designed his ships with a protective deck in place of an armoured belt, it was said that the riddling of the unarmoured ends above water would so lessen their stability as to put them in peril of capsizing. A trial was demanded, but expense forbade its being made, and the *Edinburgh*, and *Colossus*, the *Ajax* and *Agamemnon*, the *Victoria* and *Sanspariel*, with the six ships of the "Admiral" class, were all constructed on the plan of which the *Inflexible* was the model. These are the ships which are now again assailed, but there was nothing in the colission between the *Victoria* and *Camperdown* to demonstrate that if those vessels had possessed complete belts the result would have been different. It was below water, where no one has yet proposed to place armour, that the damage was done, and it seems likely that greater freeboard, more beam, better subdivision, and an improved system of watertight doors will do more to prevent the repetition of such a disaster than any extension of the armoured belt.

The Capsizing of the "Victoria."

It is stated by the Secretary of the Admiralty that a strong and independent committee of experts will be shortly appointed to inquire into the causes which led to the capsizing of the *Victoria* after she was rammed by the *Camperdown*. The names of the gentlemen who are to sit on this committee have not yet been announced, but there can be no question that the list will be carefully scrutinised by the public, and that if the report is to have the respect of the country the committee must not be packed from the departments. Probably the very best plan would be to follow the precedent of the Tay Bridge disaster inquiry, conducted by the late Mr. Rothey, but in any case it is to be hoped that the committee will spare no pains to make their investigations thorough. No one believes that it is possible to entirely obviate the disastrous effects of the tremendous power of the ram, but it is possible to built ships with ample reserve of stability, and to prevent them from turning turtle with the awful suddenness which characterised the *Victoria* catastrophe. Moreover, there is the equally important question of the efficiency of the present watertight doors and the system of closing them, which was raised by Sir Edward Harland, while it must not be forgotten that the strength of the athwartship bulkheads have been impugned. These problems are directly connected with the structure of everyone of our modern battleships, and their solution is necessary to restore the confidence of the seamen of the Royal Navy.

The "Powerful" and "Terrible."

At length an official description of these cruisers has been published, and confirms the particulars already given in these columns. There are, however, some additional facts made known, and it may be advisable therefore to now supply all the details. The principal dimensions are:—Length, 500 ft.; breadth, 70 ft.; mean draught with keel, about 27 ft.; displacement about 14,000 tons. The continuous sea-speed is to be 20 knots, and on trial 22 knots. The hull is to be sheathed and coppered. The total coal bunker capacity will be 3,000 tons, but at the above draught of water not more than half this amount can be carried. The armament will consist of two 9·2 in. guns, twelve 6 in. quick-firing, eighteen 12-pounder quick-firing, twelve 3-pounder quick-firing, and several smaller guns. Four submerged torpedo discharge tubes will be fitted. Engines, boilers, &c., will be under a 4 in. protective deck The vessel will be fitted with twin screws. The *Terrible* is not to be begun this year, but the *Powerful* is to be given out to contract, and it is reported that she will be built at Elswick by the firm of Sir Wm. Armstrong, Mitchell & Co.

Portsmouth Dockyard.

The ships of the channel and training squadrons belonging to this port have arrived and will give a fair amount of work for a time. The underwater hulls of the *Royal Sovereign* and *Rodney* were very foul, and must have materially contributed to lessen their speed and increase their coal consumption. Several vessels have gone out of the yard to make their trials, and the *Magicienne* recommissioned alongside the wharf here. The battleship *Centurion* will, it is reported, relieve the *Imperieuse* as flagship on the China station, but nothing definite is known about this at present. The contractors have commenced the work of excavating the two new 600 ft. docks here, but it will be some little time before what may be called real progress can be made. They have purchased the light railway which connects Whale Island with the dockyard, and will tip the stuff excavated from the docks to form an extension of the island. The *Resolution*, which is to take the place of the *Rodney* in the Channel Squadron, will not be ready for a couple of months yet, but the *Ramillies* is fast approaching completion. She is to go to the Mediterranean as the flagship of Sir Michael Seymour when ready. The *Devastation*, after being engined, has made her trials, and the *Vulcan* is under repair.

Some Battleship Trials.

The *Resolution*, of the *Royal Sovereign* class, built and engined by Messrs. Palmer & Co., of Jarrow, has made her trials. The

ship was not down to her designed load draught by something over 3 ft., the draught aft being 25 ft. 8 in., and forward 23 ft. 10 in. The sea was smooth and there was but little wind. The collective I.H.P. during a four hours' run was 11,379, the contract being for 11,000 H.P.; the mean air pressure was ·63 of an inch, and the mean speed 17·5 knots. At a previous eight hours' trial with natural draught 9,237 H.P. was developed, giving a speed of 16·7 knots. The *Ramillies*, a sister ship, has made her gun-mounting trials, but will have her cylinders renewed, or spare ones substituted for those on board before being ready for commission. The *Devastation*, after undergoing a thorough renovation and partial reconstruction in hull, machinery, and armament, has made her trials. In place of the engines of the direct-acting trunk type supplied by Messrs. John Penn & Sons, she has now been fitted by Messrs. Maudslay, Sons & Field with triple-expansion engines of modern type. Her draught of water was 25 ft. forward and 26 ft. 8¼ in. aft, and with an air pressure of ½ an inch 6,000 I.H.P. was developed, and a speed 13·25 knots. On September 14th she made a forced-draught trial on a four hours' run. The average air pressure was 1·03 in., the maximum being 2 in., and with this draught 7,214 H.P. was realised, and a speed by patent log of 14·56 knots.

Devonport and Keyham Yards.

An intimation has been received at this yard that the Admiralty have sanctioned the date for the completion of the *Northumberland* being postponed until the 31st March, 1894. The delay of three months is caused by the pushing on of the work of other and newer vessels. The *Warspite*, *Undaunted*, *Forth*, and *Himalaya* are undergoing extensive repairs. The *Warspite* has been commissioned by the crew of the *Triumph* as port guardship at Queenstown, the *Undaunted* will be out of hand this month, and the completion of the other vessels cannot be long deferred. The stern of the *Forth* is rather a heavy job, it having been found necessary to remove the fractured part and substitute a fresh block of metal. The *Astræd* will be ready for her steam trials before the end of the year, her machinery being the largest yet built at the Keyham factory. No further decision appears to have been arrived at with regard to the extension of the yard, although the need for larger docks, the largest at present being only capable of taking in 500 ft. ships, is very obvious. It is expected that the *Talbot* cruiser will be commenced here very soon. Torpedo tubes for the *Dryad* building at Chatham, and the *Halcyon*, *Harrier*, and *Hussar*, building at Devonport, will be made in this yard. The *Gorgon*, after her repairs, was taken out for a trial, but broke down so completely that she had to be towed back into harbour.

Marine Engineers at Chicago.

A *Globe* correspondent writes:—Marine engineers appear to have had a good time of it at Chicago. There was an assemblage from all parts of the world. Engineering in all its branches, civil, mechanical, mining, metallurgical, educational, military, and marine and naval were well represented. The last department, which was especially well attended, began with an address by Commodore Melvile, Engineer-in-Chief of the United States Navy, wherein he expressed gratification at the large number of visitors, and welcomed the foreign guests. He then gave a brief summary of the present condition of matters connected with marine engineering and naval architecture, and sketched the lines along which future progress will probably be made, calling special attention to the fact that it will probably be on about the same lines as in the past, which have consisted of an increase of steam pressure and piston speed, better material and possible changes of design to a certain extent. He mentioned that experiments are now being made with steam of 1,200 lbs. pressure, and called attention to the possibilities of the coil boiler for great power to be obtained with little weight. The first paper read was by Sir N. Barnaby, on the "Best Ship of War." About 45 papers were read and discussed during the five days the meeting lasted.

Commissions and Recommissions.

The *Phæton* cruiser having returned home from the Mediterranean has paid off after a commission which had been prolonged over the usual time. The *Magicienne* which paid off and recommissioned at Portsmouth, has sailed to rejoin the flag of Sir John Hopkins in the West Indies. The *Basilisk* sloop, which commissioned at Sheerness, 24th June, 1890. At Chatham, on Sept. 11th, the battleship, *Empress of India*, was commissioned by the crew of the *Anson* and additional hands, in all 729 officers and men, as the flagship of the second in command of the Channel Squadron. The *Anson* was commissioned Sept. 12th as a relief for the *Colossus* in the Mediterranean sea. The *Rodney* would have turned her crew over to the *Resolution*, had that ship been in readiness to receive them. The *Howe*, when ready, will also go to the Mediterranean.

Pembroke Dockyard.

The main smithy at this yard has been entirely new roofed with galvanized sheet-iron, but complaints are still made about its size, and, indeed, like much of the plant here, it is in need of renovation. The phosphor-bronze stem of the *Renown*, which was cast and fitted here, has been placed in position, and the stern post has also been cast. Messrs. Maudslay, Sons & Field, of Lambeth, are to provide 12,000 H.P. machinery for this vessel, which is to have a sea speed of 17 and a trial speed of 18 knots. This order is probably very welcome to this well-known firm. The *Cambrian* is to be completed at this yard instead of being sent to Devonport. She will probably remain here until December. Messrs. Hawthorne & Leslie, who supplied her machinery, are very gratified with the result of her trials. Some castings for the *Hazard* have been received from Sheffield, and placed in position. The *Flora*, second-class cruiser, will be launched here on 21st November.

The Complements of the Sea Ports.

In connection with the mobilisation scheme the following tables have been prepared at the Admiralty by the Intelligence Department, indicating the proportion of men of all classes and ratings which are to be borne at each of the Home ports:—

Ratings.	Required at Portsmouth.	Required at Devonport.	Required at Chatham.	Total.
Seamen	10,066	8,465	6,619	25,150
Engine-Room Artificers	611	519	496	1,626
Stoker Classes	4,408	3,359	3,321	11,095
Signalmen	424	367	323	1,114
Carpenter's Ratings	585	470	386	1,441
Blacksmith's ,,	132	90	87	309
Plumber's ,,	78	58	47	183
Painter's ,,	84	69	61	214
Cooper's ,,	93	63	67	223
Armourer's ,,	315	266	238	819
Sick Berth Staff	219	187	138	544
Writers	127	124	90	341
Stewards	188	189	140	517

These tables include the numbers in the complements of all ships in commission attached to the port for manning purposes, whether at home or abroad; care and maintenance parties for all ships in reserve; the number of men under training in the various establishments; a working margin to provide for port duties, navigating parties, &c., and for reliefs. The numbers will be subject to an annual scrutiny, so that changes in the conditions of the ports may be met.

Gunboat Steam Trials.

The official machinery trials of the gunboats *Renard* and *Leda* have been made on the Maplin. The *Renard*, engined by Messrs. Lairds, went out for an eight hours natural draught trial on the 6th of September; 2,583 H.P. was developed, and 17·6 knots. A three hours forced draught trial was made on the following day, with an air pressure of 2·5 in. 3,948 H.P. was realised, and a speed of 19·4 knots. In both cases, therefore, the contract power was exceeded. The natural draught trial of the *Leda* took place on 5th July, and has been reported. On the 11th September she made a three hours' forced draught trial. The air pressure used was 2·2 inches; 3,601 H.P. was developed, and a speed of 18·3 knots. This again was in excess of the contract demands. The *Leda* is engined by Messrs. John Penn & Sons.

Navy Records Society.

Some of our readers may like to know of the establishment of a new society which has created great interest in naval and literary circles, and bids fair to be a most successful addition to the bodies which busy themselves with encouraging and fostering a nautical spirit in this country. In addition to a large number of distinguished naval and military officers, the council of the society includes such men as Mr. Walter Besant, Mr. Oscar Browning, Mr. David Hannay, and Mr. Edward Lee. The society intends to throw light upon the history and growth of the British Navy from the earliest times by the publication of valuable memoirs, letters and diaries. Among the MSS. and rare books that are to be republished are:—Letters of Lord Howard in 1587; Monson's Naval Tracts, 1640; letters of Blake, 1652-7; the journals of

Captain Martin and Admiral Jones. In the circular issued by the society, attention is drawn to the ignorance existing among Englishmen as to the social life and status of our forefathers in the sea service. "We do not know how they lived, messed, or dressed, and the fact that a large proportion of our officers entered the service as 'captain's servants' has over and over again been put forward as a proof that they were for the most part men of low origin." It is believed that the publication of some of the 17th and 18th century papers will dispel many of these illusions, besides tending to revive public interest in the naval service. The annual subscription is one guinea, the payment of which entitles the members to copies of all the works issued in the year. Two works are now in hand. Those who are desirous of joining the society should apply to Professor J. K. Laughton, R.N., Catesby House, Manor Road, Barnet, who will submit their names to the Council.

Chatham Dockyard.

The *Barfleur* has had her steering machinery and underwater fittings examined. She will soon be ready for trial, her engines being supplied by Messrs. Scott, of Greenock. Part of her armament is already on board. The *Forte* is to be ready for launching in November. The steam trials of the *Theseus* will take place in October. The *Agincourt*, which has been supplied with new boilers, three masts instead of four, and a partially new armament, is nearing completion. There is a good deal of repairing work in hand in addition to the *Howe*, the *Anson* having to be got ready for the Mediterranean, and the ships of the Training and Channel Squadrons being under weigh. Nothing has yet been done about the alterations of the prison, but it is stated that fresh facilities are to be afforded for berthing the torpedo boats, for which there is not sufficient space in the basin. Nothing more has been heard about commissioning the *Ajax*. The *Magnificent* is to be laid down on No. 7 slip when it is made ready for her, and the *Minerva* in No. 2 dock, after the *Dryad* is launched in November. The Admiralty have directed drawings to be made for guidance in completing the *Minerva* class; those for the plating and graving of the hull and structure at this yard; those of the internal fittings at Portsmouth, and those of weather fittings relating to rig, awnings, hammocks, &c., conning towers, torpedo rooms, capstan and anchor gear, skylight, hatches and ladder-ways, towing gear, stern walk and coaling fittings at Devonport.

Some Other Machinery Trials.

The *Cambrian*, cruiser, has made natural and forced draught trials of her machinery, which was fitted by Messrs. Hawthorne & Leslie. With natural draught during an eight hours' run, 7,150 H.P. was developed, and a mean speed of 19·4 knots. During a four hours run with forced draught in the stokeholds 9,176 H.P. was realized, and a mean speed of 20·8 knots. This was a very satisfactory result. The *Serapis*, troopship, has made a run at Portsmouth. With a boiler pressure of 53½ lbs. she developed a mean of 2,812 H.P. and realized a log speed of 12¼ knots. The *Speedy*, which is a gunboat of the *Niger* and *Onyx* class, built and engined by Messrs. Thorneycroft, has been delivered at Sheerness and will shortly undergo her trials. Special interest attaches to these essays owing to the *Speedy* being fitted with the Thorneycroft tubulous boiler, and it is anticipated that the original H.P. (4,500) of this class will be developed, and a speed of 21 knots. Marine engineers are looking forward to these trials with much attention.

The Man who Mended the Boiler.

Chief Inspector of Machinery, Henry Benbow, D.S.O., who has just been placed on the retired list of the Royal Navy at his own request, is an engineer with a distinguished record. When the chief engineer of the *Helicon*, Mr. Benbow served with the Naval Brigade landed for service in the Soudan with the Nile expedition, for the relief of General Gordon at Khartoum. He accompanied Lord Charles Beresford in the rescuing steamer *Sofia*, which was sent to the relief of Sir C. Wilson. The boiler of the *Sofia* becoming damaged, Mr. Benbow personally repaired it, although the vessel was at the time under heavy and continuous fire from the enemy. Lord Wolseley, in his dispatches, selected Mr. Benbow for special mention for the splendid courage and resource he displayed during this memorable trip to the rescue of Sir Charles Wilson and his shipwrecked comrades. The particulars of the case had been brought under Lord Wolseley's notice by Lord Charles Beresford, and Lord Wolseley not only warmly thanked and praised Mr. Benbow for his brilliant feat, but as a personal testimony to his merits, presented him with his own silver cigarette- [...]he great delight of the assembled bluejackets. The [...]f the Admiralty, in the House of Commons, said: "I particularly desire to place on record the services rendered by the naval engineer, Mr. Benbow, on that occasion." In recognition of these services he was promoted from chief-engineer to inspector of machinery, with seniority of 30th June, 1885, thus passing over the whole of the staff and fleet-engineers of the service. Mr. Benbow was, in 188°, promoted to the highest position possible for him to attain in the service. He was made a Companion of the Distinguished Service Order on Her Majesty's Birthday, 1891. His last appointment was from October 1889 to October 1892, as chief inspector of machinery at Devonport Dockyard, where he won the esteem and respect of all with whom he came in contact; when shortly before his retirement Mr. Benbow married, the engineer officers of the port presented his bride with a handsome wedding gift as a token of their regard for her husband. It is not unlikely that now he has retired Mr. Benbow will find a scope for his talents in civil employ.

The "Centurion" and the "Barfleur."

Two battleships which are likely to attract attention shortly are the *Centurion* and *Barfleur*. They have been spoken of as small *Royal Sovereigns*, but there are many points of difference besides that of displacement, which in the case of these vessels is 10,500 tons. On September 19th, the *Centurion*, which was laid down at Portsmouth in March, 1891, and is engined by the Greenock Factory Co., went out for a natural draught steam trial. Her mean load immersion was 25 ft. 6 in., or exactly the designed trim. With a boiler pressure of 146½ lbs., and a 0·18 in. draught in the stokeholds, 9,703 I.H.P. was realized, and an average speed of 17¼ knots per log during 8 hours steaming. On the following day steam for a forced draught trial was raised, and the vessel ran for two hours, but without reaching the 13,000 H.P. guaranteed by contract, the trial was therefore temporarily abandoned. The failure was attributed to leakages in the closed stokeholds, which prevented the requisite amount of air pressure on the furnaces being obtained. The sister ship, *Barfleur*, is at Chatham, and although nearly finished internally, is far from being complete. The engine contractors, Messrs. Scott, of Greenock, have fitted her machinery, and she will probably make her steam trials shortly, but Messrs. Whitworth have not yet delivered the turntables and other gun mountings. She must be completed during this financial year, but will probably not go to sea as soon as her sister, which is named as the next flagship on the China station.

The Lucania.—Elsewhere we fully illustrate and describe this magnificent vessel. Her first outward voyage is referred to in the account. But possibly a note of the first homeward trip, which eclipses all eastward performances save those of the *Campania*, may be of interest to our readers. She left New York on the 16th September, passing Sandy Hook Lightship at 11.50 a.m. on that day. She reached Daunt's Rock, the goal of her journey, as far as timing is concerned, at 9.46 a.m. on the 22nd, thus making the passage in 5 d. 17 h. 21 m. She remained 1 h. 29 m. at Queenstown, and reached the Mersey at 8.47 p.m. the same day. Passage from New York to Liverpool 6 d. 3 h. 57 m. Though we allow 70 miles for the extra distance between Sandy Hook and Hunt Castle, this must be taken a faster voyage, as was her outward trip, than anything done on the Southampton route. Her daily runs were 480, 485, 415, 514, 472, 433 miles—distance 2,799 miles. It is singular that her time was within six minutes of the *Campania's* first eastward voyage. She experienced fog, the other went the long course, and the results are almost identical.

The Fairfield Exhibit at the World's Fair.—The list of awards to exhibitors in the maritime and naval sections of the World's Fair does not contain the name of the Fairfield Co. An explanation of the omission is, however, to be found in the fact that Dr. Elgar, who is a director of the company, is a member of the British Commission, and on the awards jury. The Fairfield exhibit, which comprised over 25 models, including one of the now famous *Campania*, was, in consequence of Dr. Elgar's official position, withheld from competition.

Harbours on the Fifeshire Coast.—The report is current that Methil harbour will shortly undergo large extension to meet the growing trade, and provide accommodation for a larger class of vessels. At the same time doubts are now expressed in well-informed circles with regard to the construction of the proposed harbour at Ravenscraig, Kirkcaldy, which was expected to be undertaken jointly by the North British Railway Co., and the town.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from August 26th, 1893, to September 25th, 1893:—

Anstey, Henry C. (probationary), assistant engineer to the *President*, additional, for Royal Naval College, to date September 30th.

Baldwin, George W. (probationary), assistant engineer to the *President*, additional, for Royal Naval College, to date September 30th.

Barber, James (*b*), engineer to the *Active*, to date August 30th.

Batchelor, H.R., assistant engineer, has been promoted to the rank of engineer in Her Majesty's fleet.

Bell, Henry F. (probationary), assistant engineer to the *President*, additional, for Royal Naval College, to date September 30th.

Bluett, Peter W. P. (probationary), assistant engineer to the *President*, additional, for Royal Naval College, to date September 30th.

Bone, H., assistant engineer, has been promoted to the rank of engineer in Her Majesty's Fleet.

Bromley, William (*b*), chief engineer to the *Phæton*, to date August 29th.

Carey, J. J., engineer, has been promoted to the rank of chief engineer in her Majesty's Fleet.

Carey, John J., chief engineer to the *Pylades*, to date September 7th.

Chamberlain, E. W. (probationary), assistant engineer to the *Anson*, to date September 12th.

Chisman, Edward, assistant engineer to the *Pembroke*, to date September 12th.

Cocks, Herbert W. L. (probationary), assistant engineer to the *Collingwood*, to date September 15th.

Constable, J. S. (probationary), assistant engineer to the *Royal Sovereign*, to date August 31st.

Crabtree, Ernest (probationary), assistant engineer to the *Empress of India*, to date September 11th.

Cudlip, Edwin A., engineer to the *Daring*, to date August 25th.

Cummings, G. R. T., chief engineer, has been advanced to the rank of staff engineer in Her Majesty's fleet.

Dixon, Robert B., engineer to the *President*, additional, to date September 3rd.

Drake, Percy G., assistant engineer to the *Empress of India*, to date September 11th.

Duffell, W. J., assistant engineer to the *Pembroke*, to date September 12th.

Edgar, Edward J., engineer to the *Leda*, to date September 3rd.

Edward E., engineer to the *Canada*, to date September 1st.

Elbrow, George, staff engineer to the *Polyphemus*, undated.

Evans, Henry (probationary), assistant engineer to the *President*, additional, for Royal Naval College, to date September 30th.

Everitt, A. E. (probationary), assistant engineer to the *Empress of India*, to date September 11th.

Eyre, Charles W., engineer to the *Galatea*, to date September 18th.

Ferguson, Samuel P. (probationary), assistant engineer to the *President*, additional, for Royal Naval College, to date September 30th.

Goodall, George T., engineer to the *Polyphemus*, to date September 18th.

Grant, A. R., assistant engineer to the *Rodney*, to date September 1st.

Hares, Ernest, assistant engineer to the *Anson*, to date September 12th.

Harris, H. W., assistant engineer, has been promoted to the rank of engineer in Her Majesty's fleet.

Hewitt, John B. (probationary), assistant engineer to the *President*, additional, for Royal Naval College, to date September 30th.

Hill, Walter S. (probationary), assistant engineer to the *President*, additional, for Royal Naval College, to date September 30th.

Hinks, Frederick A., engineer to the *Aurora*, to date August 25th.

Howe, Percival C. W. (probationary), assistant engineer to the *President*, additional, for Royal Naval College, to date September 30th.

Huddy, T. B., assistant engineer, has been promoted to the rank of engineer in Her Majesty's fleet.

Huddy, John B., assistant engineer to the *President*, additional, for Royal Naval College, to date September 30th.

Jarvis, F., engineer to the *Terror*, additional, to date September 1st.

Jose, F. W. R., assistant engineer has been promoted to the rank of engineer in Her Majesty's fleet.

Knight, George G., engineer to the *Nile*, to date September 7th.

Lamb, Francis E. (probationary), assistant engineer to the *President*, additional, for Royal Naval College, to date September 30th.

Legate, James (probationary), assistant engineer to the *President*, additional, for Royal Naval College, to date September 30th.

Legate, W. P. (probationary), assistant engineer to the *Polyphemus*, undated.

Leslie, George N. (probationary), assistant engineer to the *President*, additional, for Royal Naval College, to date September 30th.

Little, John A. (probationary), assistant engineer to the *President*, additional, for Royal Naval College, to date September 30th.

Liversedge, J. G., engineer to the *Sanspareil*, to date September 3rd.

London, A. J., chief engineer, has been advanced to the rank of staff engineer in her Majesty's fleet.

Main, R., assistant engineer, has been promoted to the rank of engineer in her Majesty's fleet.

May, Walter, engineer to the *Anson*, to date September 12th.

Monkhouse, Warwick, engineer to the *Vernon*, additional, to date September 15th.

Moon, R. C., staff engineer, has been advanced to the rank of fleet engineer in her Majesty's fleet.

Moore, Walter L. (probationary), assistant engineer to the *President*, additional, for Royal Naval College, to date September 30th.

Morgan, Thomas J. (probationary), assistant engineer to the *President*, additional, for Royal Naval College, to date September 30th.

Mortimer, J. E., assistant engineer, has been promoted to the rank of engineer in Her Majesty's fleet.

Mountfield, James, assistant engineer to the *President*, additional, for Royal Naval College, to date September 30th.

Moysey, Alfred H., engineer to the *Hero*, to date August 30th.

Osbourne, C. E. H., assistant engineer, has been promoted to the rank of engineer in Her Majesty's fleet.

Parsons, W. G., staff engineer to the *Empress of India*, to date September 11th.

Percy, J. J. G. G., engineer to the *Widgeon*, to date September 2nd.

Reynolds, H. E. J. (probationary), assistant engineer to the *Empress of India*, to date September 11th.

Rodet, Ernest W., engineer to the *Melampus*, to date September 15th.

Simmons, G. T., chief engineer, has been advanced to the rank of staff engineer in Her Majesty's fleet.

Smith, Frederick P., engineer to the *Dolphin*, to date September 18th.

Stuttaford, F. R., engineer to the *Empress of India*, to date September 11th.

Summerford, H. G., assistant engineer to the *Anson*, to date September 12th.

Swift, L. W. (probationary), assistant engineer to the *Ramillies*, to date September 2nd.

Teed, H. R., engineer to the *Partridge*, to date September 1st.

Vibert, John E., assistant engineer to the *Blanche*, as acting engineer, to date September 1st.

Vibert, J. E., assistant engineer, has been promoted acting engineer in Her Majesty's fleet.

Walton, John H., chief engineer to the *Forte*, to date September 4th.

Watch, J. S., chief engineer, has been advanced to the rank of staff engineer in Her Majesty's fleet.

Watson, Lewis J. (probationary), assistant engineer to the *President*, additional, for Royal Naval College, to date September 30th.

Webb, Arthur T., engineer to the *Trafalgar*, to date September 3rd.

Whayman, W. M., assistant engineer to the *President*, additional, for Royal Naval College, to date September 30th.

Wishart, W. L., staff engineer to the *Anson*, to date September 12th.

Wright, Wallace, engineer to the *Empress of India*, to date September 11th.

HOAR & BROWN'S HARDWOOD MARKET REPORT, SEPTEMBER 20th, 1893.

Teak—	TIMBER. Loads.	PLANKS. Loads.	BLOCKS. Loads.	TOTAL. Loads.
Stock, 1st Sept., 1893	7,290	2,745	26	10,061
Landings	Nil	Nil	Nil	Nil
	7,290	2,745	26	10,061
Deliveries	735	58	Nil	793
Stock, 20th Sept., 1893	6,555	2,687	26	9,268

Since our last a cargo of Moulmein timber which has lain here for some considerable time is reported as being sold for the North. The exact price at which this cargo changed hands does not transpire but it is rumoured to be an extremely low one.

Very few enquiries are about, but the low figures asked for new shipments are causing some speculation for an anticipated rise, thus making a little business for importers.

The quantity of wood afloat, regardless of steamer shipments is exceedingly limited, but a demand so restricted and low steam freights combined will tend to keep down prices for some time yet.

The enquiry for planks has fallen off, and very little business is reported. A good feature, however, is the decrease in the arrival of fresh parcels, resulting in a slight fall in stock quantities, still too heavy for the present demand.

MAHOGANY.—Judging by the eagerness displayed at the last public sale of Tobasco, one would be inclined to imagine there was no more arriving and that prices were advancing, unless, as is more than probable, there was some undercurrent at work. An attack was made especially upon anything large, and a decided advance was obtained upon this class.

Mexican is now nearly at the lowest price known for the last 20 years. During that period the market has touched the present figure of 2½d. upon four different occasions, and it is within memory that at one public sale the price was 2¼d. for straight and sound 12-13 in. wood, thus showing that it is possible for a still further decline to take place.

Cuba is being held by importers for better prices and at present there is nothing doing. The stock is very large, consisting mostly of inferior small parcels.

CEDAR.—Stocks are still light, and prices advancing, as shown by the last public auction, when a shipment of both large and small sided wood was sold at figures much above those previously recorded.

KAWRIE PINE is going off quietly. The market is fairly stocked for present requirements and prices remain about the same, just sufficient to pay the cost of importation.

SEQUOIA.—First hand stocks are held by two separate importers, who do not believe in knocking the market down, consequently both are selling at a fair price, although really very little is doing. The wood is gradually being more appreciated.

AMERICAN WALNUT.—Quotations are high for logs of any special merit, which are now scarce. The demand for medium and low qualities has fallen off almost entirely of late.

Planks band cards of good quality are selling well.

Trade as a whole has never been in such a stagnant condition during a 20 years' recollection.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(From our own Correspondent.)

IT is with feelings of great pleasure that we sit down to record a continuance of the improvement in the tone of trade in the shipbuilding and allied industries in this district. In our last Notes we predicted this state, and it is therefore gratifying in a double sense, as when we indulge in prophesying, though at rare intervals, we are always labouring under a certain anxiety, ·ecially within recent years, when fluctuations have been so len and, in some instances, unexpected. During the month of August there was launched from the whole of the Scotch shipbuilding yards 29 vessels aggregating 27,213 tons, the Clyde contributing 24 vessels of 25,278 tons, the Forth 3 of 1,075 tons, one by the Tay of 700 tons, and one by the Dee of 160 tons. Though this shows a slight falling of in the sum of production, the new orders placed have been fairly numerous, and speak well for the work to be done in the remaining three months of the year, when it will be interesting to see the total extent of the drop in production since last year. The following comparisons may be interesting :—

Year.	August. Tons.	Eight months. Tons.
1893	21,980	172,126
1892	15,404	224,361
1891	14,812	195,573
1890	36,783	228,242
1889	38,445	179,440
1888	28,297	148,133
1887	35,310	131,675
1886	6,631	116,327
1885	12,815	117,970
1884	25,123	187,827
1883	34,003	259,386

We are glad to say that the coal strike, which has so seriously affected some of our friends in the south, has practically passed over without troubling directly any of the yards here, but an almost equally unfortunate trouble broke out here on the 11th, and, though temporarily settled, we may yet hear of it. In a journal for all classes as ours is, it is, of course, very difficult to comment on any disputes between master and man; at the same time the lock-out of carpenters and joiners, which is what we refer to, can hardly come under this heading. In explanation of this affair we may say that for some time back the joiners and shipwrights employed in the various shipbuilding yards on the Clyde have been given to getting at loggerheads over what is called the demarcation question, which has been the cause of periodic friction between employers and workmen. Now to any right-thinking man it must appear out of the question that the heads of these establishments should be inconvenienced by a class of their workmen going out on strike at any moment over some slight difference of opinion with another class. In work such as carpenters' and joiners', which verges so near to one another and is so difficult to define, it is the workmen themselves who should arrange points of difference, and have these duly notified to the managers. In order to let the men do this all the yards connected with the Employers' Association closed their doors on the before-mentioned date against all shipwrights and joiners, and in consequence over two thousand men were thrown idle. The masters have, however, withdrawn the notices, and on the 20th the majority of the men resumed work on the understanding that they will, in the meantime, draw up a plan for the future guidance of managers. The whole matter may be summed up in the opinion that it has all along been a very silly quarrel, and it is to be hoped that the men will be better guided by their heads in the future, and not interfere with trade in such a manner as to force the employers to extreme measures.

Periodically a certain amount of difficulty is experienced in obtaining accurate information as to new orders, and when a considerable amount of new tonnage is being placed rumour steps in and assists the prospect by doubling the orders placed and in some instances giving firms the credit of accepting work which they could under no possible circumstances undertake. The largest orders in respect to tonnage, placed since our last report, have been secured by Messrs. Hamilton, Port-Glasgow, viz., two steamers of 5,000 tons each for Messrs. Robert Mackill & Co. Glasgow. Two steamers of about 5,000 tons were contracted for by Messrs. James Gardiner, one going to Messrs. Connell & Co., Whiteinch, and the other also falling to a Clyde firm. At Patrick, Messrs. D. and W. Henderson & Co. booked an order for a steamer of 4,500 tons deadweight for Messrs. Biggart & Fulton, Glasgow; they also in the beginning of the month purchased the steel twin-screw steamer *Islam*, a cargo boat of 5,402 tons gross and 3,507 net, built in December last by Messrs. Harland & Wolf, Limited, to Lloyd's highest class. The vessel whose dimensions are 445 ft. long; 49·2 ft. beam by 30·1 ft. depth, and steams 11½ knots, cost about £33,000, and was bought for £30,150. There is therefore every prospect of Messrs. Henderson turning an honest penny out of this transaction. At Govan, the London and Glasgow Shipbuilding and Engineering Co., Limited, secured the contract for a passenger and

cargo boat of 4,000 tons register, Messrs. Mackie & Thomson of the same district booking an order from Messrs. R. & D. Weir, Glasgow, for whom they are building a large sailing vessel, for the construction of two lighters of about 60 ft. in length. Messrs. Rodger, Port-Glasgow, have laid the keel for a ship similar to the *Glenbank*, launched from their yard this month.

Messrs. Robert Russell & Co., 8, Gordon Street, have given an order to Messrs. Russell & Co., Port-Glasgow, for a steel sailing vessel to carry 2,750 deadweight.

A number of other good orders have been, if we may use the term, almost placed, and we bring our list to a close with the two latest contracts.

Messrs. John Shearer & Sons, Kelvinhaugh, have contracted with Mr. John Simpson, 129, Hope Street, Glasgow, to build for him a steel screw-steamer of extra power, and specially de signed for his general coasting trade, to carry over 600 tons and to have all the most modern appliances.

Altogether, about 65,000 tons of new contracts have been placed in the last six weeks, and a very prosperous fall is anticipated for the employés, though we regret that the prices are not as good as the employers could have wished.

In the Steel Trade, business is more active, the demand for shipbuilding material having been increased by the placing of so many new contracts with Clyde builders. A considerable number of orders for steel have been received lately from Russia, this being due to the increase in the German export tariffs. In basic steel especially, a good demand exists, and prices remain firm, though they are still moderate. As regards shipbuilding material, makers are in a position to resist any attempt which might be made to break prices, and quote ship-plates on a basis of £5 10s. to £5 12s. 6d., less the usual 5 per cent. discount for delivery in the Clyde districts. The increased demand for bar iron renders trade busy and prices firmer. Owing to the increase in the cost of fuel, consequent on the coal strike, a rise in prices is expected, the present prices being for common bars, £5 5s. to £5 7s. 6d., best bars ranging up to £6 2s. 6d., all less the usual 5 per cent. discount. The Coal trade, though fairly busy at the beginning of the month, is now quieter, the shipments for the past four weeks have, however, exceeded those for the same period last year by about 60,000 tons.

The annual meeting of the Steel Co. of Scotland, Ltd., was held in Glasgow on the 20th ult. Sir Charles Tennant, chairman of the company, presided. In moving the adoption of the report, which showed a nett loss, after all charges and expenses, of £1,604, the chairman took occasion to say how severely handicapped they were by the heavy charges which have to be borne by steel shipped at the port of Glasgow. These charges are so heavy as to prevent the Clyde district from getting a legitimate share of the orders for Belfast, and the ports in the South and West of England. A strong effort had been made by the trade here to induce the Clyde Trust to arrange for a reduction of these charges and expenses, but without a satisfactory result. It was pointed out to the Trustees by the deputation which waited upon them that by reason of their charges the Admiralty orders had been lost to a large extent to this district, and that thousands of tons of steel were being sent from the North of England to Belfast, which but for these heavy charges would be delivered at a lower price from here. Our disability arises from the fact that the Glasgow port dues on steel are 1s. per ton higher than those of the Tyne or Tees, and that the arrangements for conveying material to the ship's side are so bad or imperfect that frequently as much as 1s. 7d. per ton has to be paid to carry steel from the railway waggons to the ship. Thus a charge of 2s. 7d. per ton has to be borne by us here in excess in of our competitors on the Tyne or Tees; 2s. 6d. or 2s. 7d. per ton on our production would make a very important improvement in the accounts, and the loss of work to the district is also a very serious consideration. Under these circumstances, the refusal of the Clyde Trustees to reduce their charges is not easily understood, and is very much to be regretted.

The s.s. *Lucania* left Liverpool on the 2nd September on her maiden voyage. Amongst those who accompanied the vessel to Queenstown were Sir John Burns, Bart., Chairman of the Cunard Co.; Sir Wm. Hozier, Bart., Lord MacDonald, Professor Ramsay, and Lord Ruthven. Mr. Andrew Lang, one of the directors of the Fairfield Company, will travel to New York in the vessel.

The first steamer of a new line from America to Leith left Newport News, Virginia, on the 5th ult. She is named the *River Garry*, and has a general cargo on board, chiefly consisting of flour and grain. The managers of the line will be Messrs. Furness, Withy & Co., Limited, of London, West Hartlepool, Newcastle, &c. The new venture is to be entitled the Furness Line.

Great activity has been experienced at Grangemouth Docks, especially in the coal shipping, the dock authorities finding it necessary to make steamers lie in the roads to wait their turn. At one date as many as 15 steamers were waiting, and the cry is "still they come." This is the first time steamers have had to lie in turn in the roads since the opening of the new docks.

Amongst the awards to Scotch firms at the Chicago World's Fair, we notice the following names, which we have not the slightest doubt amply deserve all they may get. Messrs. James and George Thomson & Co., Limited, models of steamers; Messrs. Wm. Simons & Co., Renfrew, elevating platform, ferry steamer, and models of dredgers; Messrs. Wm. Denny & Brothers, models of engines, models and photographs of steamers.

It may be mentioned here that the R.M.S. *Nile*, which has just been completed at Clydebank, is fitted with an Edmiston's Feed Water Filter, as recently illustrated in our journal. Her sister ship *Danube* is also being fitted with the appliance, and the makers—the Glasgow Patents Co., who are also the proprietors of the patents—have a large number of orders on hand for all classes of steamers. The apparatus as fitted to the *Nile* is very complete. It consists of two filters, each 2 ft. 1 in. by 2 ft. 3 in. by 4 ft. deep, connected together by breeches pipes and suitable valves. One filter may be used at a time or both together, or both thrown out of working and the water passed to the boilers by a by-pass arrangement.

We regret to announce the death during the month of Mr. Wm. Stephen, the well-known shipbuilder, Dundee. Deceased, besides being a shipbuilder, carried on an extensive business in seal and whale fishing, owned several large steamers which went regularly to Newfoundland and Davis Straits, and many years ago established the well-known Arctic tannery in Dundee. Mr. Stephen, who was of a quiet and retiring disposition, was very much respected in all circles in which he mixed, and in his death Dundee has lost one of its most remarkable commercial men.

We make the following business intimations for benefit of our readers. Messrs. T. S. McInnes & Co., of York Street, has been turned into a limited company, with a capital of £5,000 in £5 shares, the whole capital being held by Greenock gentlemen. The object of the company is the carrying on of the business of T. S. McInnes & Co., as makers of mathematical instruments, steam engine indicators, and pressure guages. The engineering establishments of Messrs. Fleming & Ferguson has been removed from the Phœnix Works, Murray Street, Paisley, to their well-known shipbuilding yard at Merksworth on the Cart. Their former works, re-named Soho Works, are now occupied by Messrs. Campbell & Calderwood, general and marine engineers, and we trust that an increase of work will justify the removal of this enterprising young firm to these extensive premises. Mr. A. Morrison, 51, St. Vincent Street, Glasgow, has been appointed Mr. Wm. Brown Rogers' representative in Scotland for the sale of Ross' patent caulking tool, illustrated two or three month ago in this journal. We should have mentioned under contracts, that Messrs. Ritchie, Graham & Milne, Craigton, are laying the keel for a small twin-screw steamer for abroad. The Montrose Shipbuilding Co. have received the order for three tug boats for Mr. Joseph Constant, London, and two barges for the Dundee Harbour Trustees.

TRADE NOTES FROM THE TYNE, WEAR, TEES, HARTLEPOOLS, &c.

(*From our own Correspondent.*)

THE TYNE.

Shipbuilding.—During September few additions have been made to the volume of work in progress on the Tyne, and it is now placed beyond doubt that the spurt which took place in this industry a couple of months ago, did not portend a genuine revival in business. True, there has been a statement put forward that Sir W. G. Armstrong, Mitchell & Company had been commissioned, by the Admiralty, to build a line of battleship, which was to be larger than the *Victoria*, and to cost a million pounds, but no sooner did the statement appear in print, than

it was promptly contradicted by the firm, who stated they had received no such order, and that no intimation had been conveyed to them, that they were likely to be so favoured. Another rumour is now current, to the effect that the same firm have a large warship to build for the Japanese Government, and though we are not in a position to affirm the truth of this, we believe it will be found that the rumour is not wholly without basis. An accession of work is very much needed at the Elswick yard belonging to the firm, as only two out of seven berths, are occupied; at the Low Water yard however matters are still worse, as there has been no new work commenced there since May, and the five vessels that are on the stocks, are nearly completed. One of the vessels, is a large passenger steamer ordered, it is said, by the Norddeutscher Lloyd of Bremen, and this will be launched very shortly. In former years the firm when short of work, have been in the habit of putting down vessels on the speculative principle, with a view to keeping the machinery going, and the men employed. That they have not done so on the present occasion, augurs ill for the immediate future, as it seems to indicate that the firm do not see any prospect of a good demand for vessels arising within the next few months. The Scotswood Shipbuilding Co. have, after a prolonged suspension of operations, commenced the construction of a large river steamer for South America, and it is stated that there will be other orders to follow. Messrs. Wigham Richardson & Co. have all their berths occupied, and are fitting out the large German passenger steamer *Pfalz*, beside the yard. The remarkable success of the s.s. *Grange*, which was built by the firm last year to the order of the Carron Co. for the passenger service between Grangemouth and London, has been the subject of much favourable notice, and there is little doubt that the s.s. *Glengariffe* which was recently supplied to the Cork Steam Shipping Co. will attract an equal amount of appreciative attention. Messrs. Dobson & Co. have three vessels on the stocks, one of which—a large steamer for the "Tower" line—is being got ready for launching. At Messrs. C. S. Swan and Hunter's yard, the state of business continues active, but so far as can be ascertained, no further orders have been booked since that mentioned in last months' Trade Notes. It is well understood however that the firm have orders enough to last them for several months. Considerable activity exists at Messrs Hawthorn, Leslie & Co.'s yard, where the second of the large meat-carrying boats building for Messrs. Turnbull, Martin & Co. of London and Glasgow, is approaching completion. The splendid steamer ordered for the augmentation of the Russian Volunteer fleet is also well advanced, and it is stated that the firm have secured another contract. Messrs. Robert Stephenson & Co. have been commissioned to build a vessel of superior type by Mr. James Knott, of Newcastle, the manager of the "Prince" line of steamers. It is understood that Messrs. Stephenson will also supply the machinery. This is, we believe, the eighth steamer that has been ordered by the same owner this year, from builders on the Tyne and Wear, and we believe the fleet of vessels now bearing the well-known prefix "Prince" does not fall far short of the half-hundred. It is reported that Messrs. Stephenson have secured another order, and should this prove to be the case, the outlook for the winter at their Hebburn yard, and also at their Engine works, South street, Newcastle, will be very satisfactory. The Palmers' Co. have obtained several orders within the past two months, and have now six vessels on the stocks, one of which is an oil-carrying steamer of large size. An army of joiners and other classes of operatives have been busily employed for some weeks past, completing the fittings of the battle-ship *Revenge*, and that the work is well advanced towards completion, may be inferred from the fact that on the 19th instant a large proportion of these men were discharged. The finishing touches are now being given to the exterior of the vessel, and it is understood that in the beginning of October, she will take her departure from the Tyne. The Tyne Shipbuilding Co. have the first of two petroleum ships which they are building for Messrs. Hunting & Son, Newcastle, in an advanced stage of construction, and two other vessels of large dimensions, are in active progress. The Edwards' Shipbuilding Co. have just placed the keels for two large vessels, and arrangements will shortly be made for putting down another. At Messrs. Readhead's yard the s.s. *Asturian Prince* is being fitted out for sea, and quite exceptional activity exists in the establishment, there being four large vessels on the stocks, the construction of which is being pushed on with energy. It is understood that the firm have other orders, and some reason for believing this may be found in the fact that the supplies of material which are being received are much heavier than usual. Messrs. Rennoldson have just now on the stocks a vessel considerably larger than those they have been accustomed to build. The vessel is, we believe, intended for employment in the coasting trade, and will be supplied with machinery of the modern improved type, by the builders. Messrs. Eltringham have very little work just now in their shipbuilding department, but Messrs. H. S. Edwards & Sons are building at North Shields two small fishing vessels for a local owner, and Messrs. Anderson & Laverick of the Mushroom Yard, are busy.

Engineering.—In marine engineering there is little change to note since last month; but, if anything, there seems to be less activity at some of the leading establishments. On the other hand, a slight improvement has taken place at one or two establishments which for some time past have been rather slack, among the latter being Messrs. R. Stephenson & Co.'s Works, South Street, Newcastle, where the booking of a limited number of orders for engines has enabled the management to augment the working staff. The manufacture of the "Rocket" oil engine at this establishment is expected to add materially to the business of more than one of the departments in the future, as it possesses many special advantages which require only to be known to be appreciated, and when the advent of a general trade improvement gives urgency to the need for motive power of an exceptionally economical and easily adaptable kind, there is little doubt that a large demand for this speciality will arise.

The well-established reputation of the packing manufactured by the Combination Metallic Packing Co., of Lombard Street, Newcastle, is causing a sustained demand for the speciality, and notwithstanding the limited amount of work in progress at marine engineering establishments, the works of the company at Gateshead are kept in steady operation. Considerable activity exists at Messrs. John Spencer & Son's Works, Newburn, where in addition to railway accessories of various kinds, crank-shafts for marine engines are manufactured. The works of Messrs. Donkin & Co. (late Donkin & Nichol), are kept steadily going, orders for steering gears, fans, ash-hoists, &c., being fairly plentiful.

Messrs. Clark, Chapman & Co. have taken up the manufacture of "Butler's" patent petroleum and gas engines, and so far very encouraging progress has been made. A launch, fitted with one of these oil engines, is now in daily use on the Tyne, and any one interested in such matters may have an opportunity of witnessing the working of the engine by appointment. The works of the firm are, on the whole, very fairly employed, the electric lighting department in particular being well off for orders.

Messrs. G. R. Toomer & Co., engine and ship repairers, &c., have commenced to fix the machinery in their new premises at Tyne Dock, and will be in a position to commence operations in the new works about the end of November. The works of Messrs. Proctor & Son, at Wallsend, continue to be well employed in the manufacture of ships' ventilators and other specialities. They have manufactured, this year, a number of ventilators which are probably unique for largeness of dimensions, excellence of workmanship, and elaborate finish. These were specially ordered for the battleships *Resolution* and *Revenge*, and among the numerous and varied accessories which go to complete the equipment of these splendid war vessels, they form a most interesting feature.

Messrs. Jas. Sample & Co. have opened show rooms near the Baltic Chambers, Quayside, Newcastle, where working models of the newly-introduced "Invincible" davits for ships' boats, and the improved releasing and picking-up gear, are daily on view. Much interest is manifested in these specialities by the numerous visitors who call to inspect them, the novel and effective arrangement of the davits more especially forming the subject of general commendation. It is understood that the s.s. *Tynesider* and other locally owned vessels are about to be fitted with these appliances. Messrs. John McKay & Co. are receiving many enquiries for the patent tube expander they have recently put upon the market, and in every case where it has been put in use, unqualified satisfaction has been expressed as to its simplicity and effectiveness.

Blyth.—The Blyth Shipbuilding Co. having completed the fitting out of the fine steamer *Lemgo*, which was launched by them last month, are scarcely so busy as they were a short time ago, but they have still two vessels on the stocks, and it is to be hoped will secure other contracts before the most advanced of these is ready for launching. The company have some repair work in hand, but not by a long way so much as their exceptional resources would enable them to deal with. The importance of this port, as a coal shipping centre, is increasing with almost pheno-

minal rapidity, and the development in this direction can hardly fail to have a beneficial effect on other local industries. A firm under the title of the Elastic Metallic Packing Co., have commenced the manufacture of a new description of packing, the nature of which is indicated by the name given. It has been tried with success in the engines of the s.s. *City of Worcester*, and has also been used by the Ashington Coal Co. for their locomotive engines and air compressors. It is very highly spoken of, and if it is found to possess the special merits claimed for it, is pretty certain to command a large sale.

Electric Lighting.—Since last month Messrs. J. H. Holmes & Co. have added considerably to their list of contracts for ship installations, and great briskness continues to exist at their works. Messrs. Ernest Scott & Mountain have just completed for the Shilbottle Coal Co., an electric pumping plant of quite exceptional capacity. The plant was put in operation before leaving the works, and the trial, which was witnessed by a number of gentlemen connected with local industrial establishments, was, in every sense, a success. On the occasion of the trial an electrical drilling apparatus which was put in operation, also excited a good deal of interest.

THE WEAR.

Shipbuilding.—Messrs. S. P. Austin & Sons have commenced the erection in their yard of new buildings, which are to be utilised as blacksmith's and anglesmith's shops, and they are also about to erect new frame and plate furnaces. This will constitute the completion of a programme of improvements entered upon some time ago, when an important addition was made to the area of the yard by the acquisition of a piece of ground adjoining. The removal of the old smith's shops will enable the firm to increase the number of building births, and as a quantity of new plant will be put down, the productive capacity of the establishment will be largely augmented. At present the firm have two new steamers in progress, and have besides a fair amount of repair work in hand. The Strand Shipbuilding Co. have commenced the construction of a second vessel ordered by local owners, and are now much busier than they have been for some time past. Messrs. J. L. Thompson & Sons are still well employed, and are likely to continue so for a few months yet. So far, this year they have had a very large output, and are likely, when the accounts of tonnage built during the twelve months come to be made up, to exhibit a record in production on the Wear. At Messrs. Doxford's yard work is pretty active, there being a 9,000 ton cargo steamer in the framing stage, and two or three smaller vessels in more advanced stages. The whaleback steamer which was launched by the firm in June last, has just left her moorings at the yard, and at the time of writing is taking in coals at the South Dock, where, owing to her novel design, she is the object of much attention. Messrs. Short Bros. continue extremely busy, and Messrs. John Priestman & Co. have commenced the construction of an exceptionally large vessel, ordered by Hartlepool owners. At the Deptford yard a satisfactory state of briskness is maintained, and Messrs. R. Thompson & Sons are moderately well employed. Messrs. Blumer & Co. have two vessels in progress, and at Messrs. Bartram & Haswells' yard there is a large vessel on the stocks, and another in preparation. The Sunderland Shipbuilding Co. are framing a large vessel, the work of which will keep a good portion of the hands employed for some time to come.

Engineering.—In the marine engineering establishments the state of business has undergone little alteration, and the improvement that was noticeable a month ago has not been further developed. At the Palmer's Hill works the engines of the locally-owned steamer *Ottawa* are being repaired. At most of the smaller works business is slack; but forges and foundries keep fairly well employed. At the Monkwearmouth Ironworks business is pretty active, the local demand for specialities manufactured being fairly well maintained. Messrs. Dawson & Usher, rope manufacturers, Hendon Road, continue to be well employed on the orders for ships' rigging, &c.

The Hartlepools.—Messrs. Furness, Withy & Co. have launched two of the large cattle boats they are building for the Chesapeake and Ohio Steamship Co., and they have still one on the stocks in an advanced stage of construction. Messrs. W. Gray & Co. have most of their building berths occupied, and at Messrs. Irvine & Co.'s yard the initiatory work connected with the building of a good sized steamer, is in progress. There are some repair contracts in course of execution; but this class of work is likely to become more plentiful towards the close of the year. At the Central Marine Engine Works, the most important feature that has been presented during the month was the exceptional activity in the sheerlegs department, three vessels of unusually large dimensions having been launched from three different building yards, and each requiring to be fitted with machinery at the Central Works during the same month. The first and largest of these was the *Maori*, built by Messrs. C. S. Swan & Hunter, of Wallsend-on-Tyne, to the order of the Shaw, Savill & Albion Co., Limited, London. This vessel has a displacement, when loaded, of nearly 11,000 tons, and is fitted throughout with insulation and refrigerating apparatus. She has capacity for carrying 75,000 sheep carcases at a time. Her engines are the largest that have yet been made at the Central Engine Works, and are fitted with all the latest improvements. The boilers are worked on Howden's forced draught system, and supply steam not only to the main engines, but also to six large sets of refrigerating engines. The vessel was expected to steam back to the yard of the builders at Wallsend, before the end of September. The second vessel was the *Chickahominy*, built by Messrs. Furness, Withy & Co., Limited, for the Chesapeake and Ohio Steamship Co. This also is a vessel of exceptional dimensions, and is intended for employment in the cattle trade. The third is the *Bullmouth*, being the sixth of the large oil boats built by Messrs. Wm. Gray & Co., Limited, for Messrs. Samuel & Co., of London.

In our next issue we hope to be able to give the results of the trials of these vessels, as they will probably take place before the end of October.

The trial of the s.s. *Appomattox*, built by Messrs. Furness, Withy & Co. for the Chesapeake and Ohio Steamship Co., and engined by Messrs. Thos. Richardson & Sons, took place on the 17th ult. The engines are of massive design, suitable for Atlantic trading, the cylinders being 28 in., 44 in., and 72 in., in diameter, with a stroke of 48 in. The crankshaft is Messrs. Thos. Richardson & Son's well-known built type, in three interchangeable pieces, and is made of the very best ingot steel, considerably in excess of the Board of Trade and Lloyd's requirements. The boilers are fitted with twelve Morison's Suspension Furnaces, which on account of their practical advantages and great strength, are now being largely used. Geddes's protector firedoors are fitted, and as these render the work of firing a very easy matter, it is not surprising to hear that they are in good demand. The machinery has been constructed under the personal superintendence of Mr. G. MacFarlane, the consulting engineer of the company, and at the trial the various details were worked under his inspection, and obtained his approval. Mr. Morison, the general manager, and Mr. Robinson, the outside manager, were present on behalf of the engine builders, and Messrs. Withy & Sivowright representing the shipbuilders. The trial was most satisfactory, a speed of 13½ knots having been attained.

Stockton.—At the yard of Messrs. Ropner & Son, there are several vessels of large size in different stages of progress, and Messrs. Richardson & Duck have also a fair amount of work in hand. Messrs. Blair & Co. continue to be well supplied with orders, and the various departments of their establishment are kept pretty busy. Only one vessel that has been engined at the works has had a trial trip during the month of August. This was the s.s. *Scarsdale*, built by Messrs. Richardson, Duck & Co., of Stockton, to the order of Messrs. Lucas & Co., of Bristol. The cylinders of the engines were 22 in., 36 in., and 59 in. diameter by 39 in. stroke. The engines and boilers were constructed to work at 160 lbs. pressure of steam, and the results of the trial were in every way satisfactory. The works of the Malleable Steel and Iron Co. are kept in steady operation, and the output of steel plates has for some time past been particularly heavy. The Stockton Forge Co. are keeping tolerably busy, and the bridge works and foundry of Messrs. Wrightson, Head & Co., show a moderate degree of activity. Boiler works are generally well employed, and manufacturers of gas making plant are busy.

Middlesbro'.—The shipbuilding yards at this centre are, up to the present, keeping fairly busy; but at Messrs. Raylton, Dixon & Co.'s yard, it is understood that the last vessel on order is now being placed on the stocks, and work at the frame furnaces has been suspended. The outlook for the winter months at this establishment is consequently not very bright. Messrs. Craggs & Sons have a good sized fruit steamer in the plating stage, and a duplicate vessel in an earlier stage of construction. Messrs. Harkess & Sons have during the last few weeks sent to sea two steamers built at their yard, both of which have proved

remarkable successes. The firm are now turning frames for a steamer of special type, to have a carrying capacity of 1,300 tons. The firm have also an important repair contract to carry out on a locally owned steamer. Most of the engineering establishments are well off for work, and iron works are doing tolerably well. Messrs. Bolckow & Vaughan have resumed the manufacture of steel plates after a twelvemonth's suspension of operations; but the output, which is considerable, is being almost wholly absorbed by orders from Continental shipbuilding firms. In general trade, a better tone exists at this important centre, and enquiries in regard to certain special products have become more numerous.

Darlington.—The steel works at this centre show an improved state of business, and in some other branches there is a fair degree of animation. At the Darlington Forge Co.'s Works, there are some good orders in course of execution.

THE MERSEY.

(*From our own Correspondent.*)

THE continued coal stoppage has during the past month tended to more or less disorganize operations throughout the engineering and iron trades of this district, and has tended to render still more unsatisfactory the previous discouraging outlook. It is not only that engineering establishments have been put to greatly increased cost in obtaining supplies of fuel, which, in many cases has compelled them to go on short time, but the damping down of furnaces, and the stoppage of iron works has introduced further difficulties in the way of obtaining supplies of material. One or two of the largest engineering establishments in Lancashire have had to shut down more than three parts of their plant, owing to the increased cost of fuel. In other cases operations have been considerably interfered with by the delay in obtaining supplies of castings, forgings, and finished iron, from works that have been either partly or wholly stopped as a result of the dispute in the coal trade. This serious interference with operations throughout the engineering trades of the district has necessarily made itself felt upon the Trades' Union organization, which have had to report a largely increased number of members coming upon the books for out-of-work support. The returns of the Amalgamated Society of Engineers show that in the Manchester district, fully ten per cent. of the members have, during the past month been upon the funds, in receipt of out-of-work benefit, whilst throughout the country generally the number has risen to nine per cent. of the total membership. The Steam Engine Makers' Society has not suffered so much in the Manchester district as in some of the actual mining centres, but the returns for this Society show an increase of fully one per cent. during the month, of members in receipt of donation benefit.

With regard to the general position of the shipbuilding industry there is no material change to notice from what we reported last month; all through, things continue very quiet, with very little new work of any kind coming forward or in prospect. Messrs. Laird Bros., of Birkenhead, have, during the past month, completed another of the gunboats they have had in hand for Her Majesty's Government. This gunboat has been named the *Renard*, and during her eight hours continuous steaming trial the following results were obtained:—speed, 17·6 knots, total I.H.P., 2,584, revolutions 218, and air pressure ·83. This trial was entirely satisfactory, the power being in excess of that contracted for, and obtained with much less air-pressure. During subsequent trials, with three hours full power forced draught, still more satisfactory results were secured, being the highest yet obtained with any vessel of her class. These results were as follows:—speed, 19·4 knots; total I.H.P., 3,949; revolutions, 254, steam pressure, 145 lbs., and air pressure, 2·7 ins. It may be added that Messrs. Laird Bros., the builders of the celebrated *Rattlesnake*, have been remarkably successful in the exceptionally satisfactory results obtained with the vessels built by them of the torpedo and gunboat type for Her Majesty's Government and foreign powers, and with the *Renard* they have scored another decided success. During the month, the firm have also launched a first-class torpedo boat for Her Majesty's Navy, in which steel has been used in the construction of the hull and the machinery is of the inverted triple-expansion type, to give great speed. The engine and boilers were put on board the same afternoon that the boat was launched, and she is to be pushed forward for early completion.

In the iron market business has been dragging on simply from hand to mouth, with prices about stationary. In many cases consumers have been uncertain as to how they would be able to keep their works going, owing to fuel supply difficulties, and they have consequently been buying just as they required, whilst generally the disposition has been to purchase as little as possible until the resumption of work at the collieries gave some more settled outlook for the future. In pig-iron the demand has been restricted almost entirely to foundry qualities, as the local forges have, with the exception of here and there one or two mills kept going on special work, been altogether stopped. Lancashire makers of pig-iron have also had to damp down their furnaces, owing to the stock of coal they held having run out, but they have been supplying small parcels of foundry iron out of stock at about 46s., less 2½, delivered to consumers. With regard to distinct brands of pig-iron, only about four of the Lincolnshire furnaces have been kept going, but notwithstanding this restricted production, they have been unable to obtain any appreciable advance in prices. For forge qualities there has been some demand from South Staffordshire, which has enabled makers to get about 35s., net cash, on trucks, which itself may be regarded, under the circumstances, as an extremely low price, whilst for foundry they have not been getting more than about 41s. 6d. to 42s., with Derbyshire quoted at about 48s. 6d. to 49s., net cash, delivered in this district. Outside brands have been tolerably firm, but have shown no really quotable advance, except, perhaps, some slight stiffening in Scotch. Delivered in this district Middlesbro' iron has been readily obtainable at from 43s. 10d. to 44s. 4d., whilst for Scotch iron the full prices obtainable for delivery at the Lancashire ports have been 46s. to 46s. 6d. for Eglinton, and 47s. to 47s. 6d. for Glengarnock, net, prompt cash.

In the manufactured iron trade there have been no quotations whatever by Lancashire makers, so far as prompt delivery is concerned, but in one or two cases they have been delivering out of stock, or running a mill or so on exceptional work at special prices. For delivery after the resumption of work at the collieries, orders have, however, been booked at £5 10s. to £5 12s. 6d. for bars. With the recommencement of work at the pits in North Staffordshire, iron makers in the above district have again been offering in this market at about £5 12s. 6d. to £5 15s. for immediate delivery, but it has been rather difficult to get prompt execution of orders.

The steel trade has been extremely quiet, with very little variation in prices, where quotations have been made, good foundry hematites having averaged about 54s., less 2½, and steel boiler plates, about £6 10s. delivered in this district. For steel billets, however, quotations have been withdrawn, owing to the stoppage of works.

In the metal market there has been a moderate business coming forward with an advance in prices, in copper wire and sheets, and the list rates for delivery in this market are now as under:—solid drawn brass boiler tubes, 5¼d.; solid drawn brass surface condenser tubes, 6½d.; solid drawn copper tubes 7¼d.; brazed copper gas and steam tube, 7d.; brazed brass gas tube, 6½d.; brazed brass machine tube, 6¼d.; brass wire, 5¼d.; copper wire, 6¼d.; rolled brass, 5¼d.; sheet brass, 6¼d.; yellow metal bolts, 5½d.; yellow metal condenser plates, 5¼d.; cast composition sheathing nails and spikes, 5¾d.; cast red metal sheathing nails and spikes, 7¼d.; wrought copper rivets, 8¼d.; wrought copper boat nails, 8¼d. to 9½d.; wrought copper tacks, 11¼d. to 1s. 2¼d.; cut copper nails, 8d. to 9¼ per lb., and copper bolts, £61 per ton.

Business in the timber trade has been exceedingly difficult and although there was an improved tone during last month, this has since almost entirely disappeared. Imports of most articles have been quite ample, and with only a dull demand, values have been barely maintained. Full stocks of all descriptions of wood are held, and in some instances, these are considerably in excess of requirements. Of East India teak only one small parcel has been imported, and although deliveries have been on a larger scale than of late, the demand is far from active, and prices continue unchanged, with stocks ample. Of greenheart one cargo has arrived, but this has met with no enquiry, the demand having almost entirely fallen away, and stocks are heavy.

In the coal trade business has been altogether in such an abnormal position, owing to the stoppage of the pits, that quotations are of very little value, except as indicating the high prices

which consumers have had to pay temporarily to secure supplies. With the gradual exhaustion of stocks, there has necessarily been a steady upward movement, until round coals have got up to 17s. 6d. and 20s., and engine fuel to 14s. and 15s. per ton, at the pit mouth. Supplies have, however, been coming in pretty freely from other districts where the pits have been working, and for manufacturing requirements, coal has been coming in from Scotland, Durham, and North Staffordshire, at prices considerably under what Lancashire colliery owners have been asking, round coal from the above districts being delivered at stations at about 16s. to 18s. per ton, whilst engine fuel has also been bought in at about 14s. to 15s. per ton, delivered.

With regard to the shipping trade, business has gradually passed entirely out of the hands of the Lancashire colliery owners, and supplies have been obtained almost exclusively from Scotland and South Wales, steam coal from the above districts having been offering pretty freely at the ports on the Mersey at about 14s. 6d. to 15s. 6d. per ton.

NORTH-WEST OF ENGLAND.

(*From our own Correspondent.*)

Barrow.—There is a rather better report to give this month of the shipbuilding and engineering trades, although the actual demand for new tonnage has not improved. There is, however, a fair enquiry from many shipowners, and it is anticipated some of these enquiries will result in good business. There is some talk of large Admiralty orders coming to Barrow, not only for the British Government, but for other Governments who are on the look-out for modern war vessels at the present time. During the month the British and African steamer *Bathurst*, has been dispatched, and has run a very satisfactory trial trip. A sister ship to the *Bathurst* is now on the stocks, and is almost ready for launching. Two keels have been laid during the month, one for an 8,000 tons steamer for Mr. Logan, of Liverpool, and another for a high speed twin-screw channel steamer for the Liverpool and Dublin trade. The engines for H.M.S. *Flora*, together with the boilers, funnels, and other fittings, have been dispatched during the month by steamer to Pembroke. Some other good engineering orders are expected at Barrow. A considerable repair work is going on at the present time to two Clan Line boats, and one or two other vessels which it has been found desirable to modernise are expected to come to Barrow. An old mail steamer, the *Rhein*, is being broken up at Barrow, and in all probability other old types of steamers will have to share the same fate, the hulls being too old to justify the owners having new types of engines fitted.

Shipbuilding Material.—There is only a small demand for this class of material, and the mills at Barrow have now been stopped since November last, but there is a probability that some improvement will shortly take place. At the Barrow works the soaking pits will be introduced such as are now at the Bessemer depots, whereby great economy will be insured in production, not only in the amount of labour entailed, but there will be a saving in the cost of fuel. When this is done there is every reason to believe that Barrow will be in the front rank of the Siemens-Martins steel manufactories in the successful and cheap production of steel. It will certainly conduce to the satisfactory and successful carrying out of the shipbuilding industry itself.

The Petroleum Trade.—At the Kerosine Co.'s storages at Barrow, which is situated on the south side of the Ramsen docks, additional storage tanks of very great capacity are being added to those which are already built. The object of these additional tanks is the storage of another class of oil. A considerable trade has been done in the importation of bulk petroleum and other oils since this trade was inaugurated in connection with Barrow.

Torpedo Boat.—On Saturday, September 16th, a first-class steel torpedo boat for Her Majesty's Navy was launched from the works of Messrs. Laird Brothers, at Birkenhead. Mr. J. C. Smale, visiting Admiralty overseer, was present. The machinery is of the inverted triple-expansion type, and will give great speed.

Skin Friction.—We have heard little of Mr. Edison lately, but if the latest interviewer is to be credited, he has turned his fertile brain to our own department. It appears that he has been struck, as, indeed, have been many other scientific men, by the great waste of power in even the most economical steamers. He takes the *Campania* and points out that of the 30,000 H.P. which is constantly being developed, comparatively little goes to drive the ship. He does not dwell or even notice the losses in overcoming the *vis inertia* of the heavy engines, or the immense losses by friction at the bearings. These are matters for smaller minds to tackle. He seizes upon the difficulty of skin friction. Here he says the vessel is exerting her enormous power, not for the purpose of driving herself along through the seas, so much as to move a vast quantity of water along with her at a speed varying according to its proximity to her hull. This is all true enough, and the discovery of the cost of skin friction has probably to account for all the various bottom coating and anti-fouling compositions with which the market has been flooded ever since iron ships were introduced. Mr. Edison, however, is an advocate of no anti-fouling composition. He believes in cheap oil. He does not suggest it for the purpose of stilling the waves—a purpose for which it is undoubtedly most effectual, and one whereby it would indirectly of course, hasten the progress of the ship. He proposes a much bolder plan. He would force the oil to exude from the sides under pressure, and the vessel would at once glide through the water, and with her present engines and consumption the *Campania* would cross in four days at most. It seems, perhaps, foolish to discuss this tale seriously. But it may be observed that to achieve this object the vessel would have to be practically in a bath of oil. That might be a convenience to the designer of warships, who has so long had a difficulty in making his weights agree with his displacement that the suggestion of a denser medium would be welcome. The denser medium, too, would retard progress if forced out too quickly. The idea, however, of a vessel carrying enough oil for the purpose suggested during a period of four days sounds rather like one of Baron Munchausen tales. We remember that that distinguished scientist, now deceased, finding himself unsupported on one occasion, lifted himself up by his pigtail, which seems quite a similar proceeding to the present. Another difficulty would be found in the power required to force the oil out. The person who evolved this precious idea could have had very little notion of the aggregate pressure on a ship's hull, and the power he would have to contend against in executing his scheme. Somebody appears to have been badly hoaxed, and if we take this as the fruit of Edison's imagination, we may find ourselves of that number.

The Times of India announces with regret the death of Khan Bahaahur Jamsetjee D. Wadia, which occurred at the Fort, Bombay, on 19th August. He held the post of master builder of the Bombay Government Dockyard for a number of years, and retired on pension in 1885. With his retirement ceased the long line of Parsee master-builders, who, in the persons of members of the Wadia family, had for upwards of a century and a half played so honorable and prominent a part in the naval history of Bombay. The early representatives of the family were responsible for the construction of many of the grand old East Indiamen, which, prior to the introduction of steam and the opening up of the overland route, conducted the commerce of India. In later days the Bombay dockyard had less to do with naval construction than in the period when ironclads were unknown, but as a place for refitting and repairing, it was without a rival in the East. For many years past most of the important practical work of the dockyard had been performed by Mr. Jamsetjee Wadia.

H.M. Battleship "Revenge" will leave the yard of Palmer's Shipbuilding and Iron Co., Limited, Jarrow-on-Tyne, at about one o'clock p.m. on the 7th October. This vessel forms a record in naval shipbuilding. It is only 86 days since the sister ship *Resolution* was delivered. She has only been 2 years and 7 months in construction; she was launched in one year and 8 months after her keel was laid. She has been completed in 11 months from the date of launching, and is altogether, for a vessel of such magnitude, so complicated and so complete, without example in private shipbuilding yards. The *Royal Sovereign* was built in about the same time in one of the dockyards, and in some respects exceeds the shipbuilding performance upon the *Revenge*. The dockyard, however, did not supply the machinery. The *Revenge* has been built and engined entirely by Palmer's Co., who not only built the ship and engines, but manufactured all the material of which she is constructed.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Advance.—On August 28th a wooden sailing ketch of about 71 tons was launched at Pembroke Dock, owned by Messrs. W. Francis.

Ayresome Ironworks, No. 2.—On August 29th there was launched from the Cleveland Dockyard of Sir Raylton Dixon & Co., an iron hopper barge, which has been built to the order of Messrs. Giers Mills & Co., of the Ayresome Ironworks, Middlesbrough, for the purpose of carrying slag from the ironworks for depositing out at sea. The hoppers are fitted with heavy hinged doors with the necessary gear for promptly discharging their contents and closing up again. The dimensions of the vessel are:—Length, 110 ft. by 29 ft. 6 in. by 11 ft. 3 in., with a hopper capacity of about 350 tons of slag. As the vessel was leaving the ways she was named *Ayresome Ironworks No. 2*.

Austrian Prince.—On Aug. 29th there was launched from the shipbuilding yard of Messrs. John Readhead & Sons, West Dock, South Shields, a steel screw steamer of the following dimensions:—Length, 350 ft.; breadth, 42 ft.; depth, 28 ft. 9 in. The vessel is of the spar-deck type, with clipper stem, poop bridge and forecastle, classed 100 A1 at Lloyd's under special survey, and will be fitted with the latest appliances and improvements for a general cargo trade, including steam steering gear, direct acting steam windlass winches, by Emerson, Walker & Co., electric light, &c., and has accommodation in bridge house for passengers, officers and engineers, and spacious accommodation in forecastle for crew. The engines, also built by Messrs. Readhead & Sons, are of the triple-expansion type, having cylinders, 24 ins., 40 ins., and 66 ins. by 45-in. stroke, steam being supplied by two large steel boilers having a working pressure of 160 lb. The vessel has been built to the order of the Prince Steam Shipping Co., Limited, Newcastle, Mr. James Knott being the managing director. The construction of the hull was superintended by Mr. M. C. James, and the engines by Mr. John Traill. As the vessel left the ways she was named *Austrian Prince* by Miss Newton.

Imbricaria.—On Aug. 29th, the *Imbricaria*, an iron steam trawler of 100 ft. in length, with 20 ft. 6 ins. beam, and 11 ft. in depth, was launched from the shipyard of Messrs. Cochrane & Cooper, at Grovehill. She was built to the order of the North Eastern Steam Fishing Co., of Grimbsy, and is the eighth vessel which the same firm has constructed for the Company. Amongst the company present at the launch was the Mayor of Grimsby, Alderman Doughty, whose little daughter christened the vessel as she glided gracefully down the ways broadside into the water. A few friends subsequently breakfasted at the Beverley Arms Hotel, under the presidency of the Mayor of Grimsby, who proposed the health of the builders, and also of Messrs. C. D. Holmes & Co, of Hull, who will supply the vessel with 45 H.P. triple expansion engines. The Companies with which he was connected, his Worship observed, had had several steamers built by Messrs. Cochrane & Cooper, and they were highly satisfied with them. They paid a good price for them, but they got excellent work in return, and in the end it was the cheapest thing to get the best article. He was glad to say that several more orders had come to the same firm, and he had no doubt whatever that the results would be of the like satisfactory character.—Mr. Cochrane replied to the toast, and proposed the health of Miss Doughty, which, with others, was cordially honoured.

Nancunium.—On August 29th a steel schooner-rigged steamer of about 661 tons, was launched at Willington Quay, owned by Messrs. F. Renwick & Co., Newcastle.

Cardiff.—On Wednesday, August 30th, Messrs. Edward Finch & Co., Limited, successfully launched from their shipyard at Chepstow a handsomely modelled steel screw tug, built to the order of Messrs. The Brazilian Coal Co., Limited, for their Rio de Janeiro Depôt. The vessel is No. 162 in the builders' books, and is the second tug-boat built by Messrs. Finch & Co. for this firm. Her principal dimensions are:—Length, between perpendiculars, 90 ft. 1 in.; breadth, 17 ft. 3 in.; depth, top of keel to top of beam, 9 ft. 7 in. She has been built under Lloyd's special survey for 100 A class for tug purposes. She has accommodation for captain and engineers aft, and for crew forward. The vessel will be fitted with compound [illegible]ensing engines 16 in. and 30 in. by 20 in. stroke, made by the builders, and boiler 10 ft. diameter by 9 ft. 9 in. long, with two furnaces 3 ft. internal diameter, with a working pressure of 100 H.P. per square inch. As she left the ways she was gracefully christened *Cardiff* by Miss Rowe, daughter of the managing director.

Kansas City.—On August 30th there was launched by Messrs. John Blumer and Co., at North Dock, Sunderland, the steel screw steamer *Kansas City*, built to the order of Messrs. Charles Hill and Sons, Bristol, to class 100 A1 steel at Lloyd's. The vessel is built under the three-deck rule. Her dimensions are:—Length over all, 306 ft.; breadth, 39 ft.; and 25·9 ft. depth moulded. The engines, which are of the triple expansion type, are being constructed by Messrs. Blair & Co., Stockton-on-Tees, and have cylinders 23½, 39 and 64 ins., with a stroke of 42 ins.

Ocean.—On August 30th a steel steam sloop of about 138 tons was launched at Sudbrook, owned by Messrs. Osborn & Wallis.

Westburn.—On August 31st a steel schooner-rigged steamer of about 3,200 tons was launched at Sunderland, owned by Messrs. James Westoll, of Sunderland.

Rescue.—On September 2nd there was launched from the ship-building yard of Messrs. Anderson, Laverick & Co., Limited, at Newcastle-on-Tyne, a finely-modelled steel screw tug, named the *Rescue*, which has been built to the order of Mr. Joseph Constant, London. The vessel is built to class 100 A Lloyd's, and is fitted complete with all latest improvements for vessels of her class, including a substantial iron-bound fender carried right round the vessel, powerful steam windlass, and a substantial towing gear, capable of manœuvring the largest modern steamers. All woodwork on deck is of teak, and two well-appointed cabins are fitted fore and aft, for the accommodation of officers and crew respectively. The vessel will be fitted with compound surface-condensing engines, having cylinders 14 in. and 28 in. by 22 in. stroke, with steam supplied from an exceptionally large multitubular boiler, working at 120 lb. pressure. The machinery, it is anticipated, will enable the vessel to tow a fair size of craft at an average speed of about eight knots under usual conditions. This is the second vessel launched within the last two months for the same owner by the builders.

Aristea.—On Monday afternoon, September 11th, there was successfully launched by Messrs. Robert Thompson & Sons, from their Southwick yard, the steel screw steamer *Aristea*, built for Captain A. K. Saliaris & Co. The following are her dimensions:—Length, between perpendiculars, 263 ft.; breadth, 36 ft.; depth, moulded, 19 ft. 2 in. She is built to class 100 A1 at Lloyd's under special survey, with cellular double bottom fore and aft for water ballast, and constructed with short poop, raised quarter-deck, and part awning deck. The vessel is fitted with four powerful steam winches, by Clarke, Chapman & Co.; hand and steam steering gear, by Davis & Co.; patent donkey boiler, by James Blake, of Manchester, and windlass, by Emerson, Walker & Co. The engines, which will be supplied by Messrs. George Clark, Limited, have cylinders 20 in., 33 in., and 54 in., with a stroke of 36 in.; two boilers, 12 ft. 6 in. diameter by 10 ft. long. During construction, both hull and machinery have been superintended by Mr. William Law, of Liverpool.

Dulwich.—On September 11th Messrs. Ropner & Son launched at Stockton-on-Tees a spar-decked steel screw steamer of the following dimensions:—Length, between perpendiculars, 330 ft.; breadth, 43 ft.; depth, moulded, 29 ft. 6 in. She will be classed 100 A1 at Lloyd's, and carry over 5,000 tons deadweight on Lloyd's freeboard. The vessel will be fitted with triple-expansion engines by Messrs. Blair & Co., Limited, of 1,200 I.H.P. She has been built for London owners and was christened *Dulwich*.

Germania.—On September 11th a fair number of spectators assembled at Messrs. Cochrane & Cooper's iron shipbuilding yard, Grovehill, to witness the launching of a fine steam trawler built by the firm to the order of the International Steam Trawling Co., Grimsby. It may be stated, as showing the satisfaction which the Beverley builders have given their patrons, that this is the seventh trawler built by them for this company, and they have three further vessels to build for them, as also three for the North-Eastern Steam Fishing Co., and one for an Ostend firm. The ceremony of "christening" the vessel—named the *Germania*—was gracefully performed by

Mrs. James Schofield, wife of the founder, and one of the directors of the company. It may be interesting to note that the launch had to be made broadside, the river being so narrow. Her dimensions are 100 ft. by 20 ft. 6 in.; depth of hold, 11 ft.; she is fitted with 45 H.P. triple-expansion engines by Messrs. C. D. Holmes & Co., Hull; built with all the latest improvements for fast steam trawling; cabin and state-room, fitted with solid mahogany; and the vessel is built to Lloyd's in A1 class, special survey. Sudron's patent for heaving up the gear has been supplied.

Bullmouth.—On September 12th Messrs. Wm. Gray & Co., Limited, launched the splendid steel screw steamer *Bullmouth*, the sixth of the steamers they have built for Messrs. Samuel & Co., of 31, Houndsditch, London, for the bulk petroleum trade to the East, through the Suez Canal. The *Bullmouth* is a sister ship to the *Elax* and *Volute*, which have already made successful voyages. She will take Lloyd's highest class and is built on the awning or shade deck type. Her dimensions are:—Length, over all, 358 ft. breadth, extreme 45 ft. 6 in.; depth, 28 ft. 6 in. The engine and boiler rooms are in the after part of the vessel, and underneath them there is a double bottom for water ballast. The forward and after peak are also fitted for water ballast for trimming purposes. Forward of the boiler room there are nine strong transverse bulkheads, and also a very strong fore and aft bulkhead from the keel to the main deck. Altogether there are 13 separate oil tanks. These oil tanks are separated from the boiler room and bunkers aft, and from the cargo hold forward by large cofferdams, which are carried to the shade deck in each case, and which can be filled with water when required, and they are under the control of special and separate pumps placed on deck. Expansion trunks are carried up from the middle of each oil compartment to allow the oil to rise and fall with varying temperatures. These trunks in conjunction with large hatchways will be used for loading general cargo. Two powerful pumps are fitted in the pump room amidships for discharging the oil cargo. They are capable of pumping out the entire cargo of over 4,900 tons of oil in 12 hours, and will also pump water from the sea to fill the oil tanks when required for water ballast. When the oil cargo has been discharged, the tanks will be cleansed and adapted to receive general cargo by special means provided. A powerful fan will be fitted capable of exhausting the air from each tank in ten minutes, in order to thoroughly ventilate the compartment when filled with general cargo, the exhaust air being delivered through a cowl a good way above deck. The vessel will be fitted throughout with an electric light installation by Messrs. J. H. Holmes & Co., Newcastle-on-Tyne, lighting the whole of the cabin, engine and boiler room, galley, chart and wheelhouse, binnacle and telegraphs, &c. In addition, she will have a 20 in. projector, and the necessary lighting for navigating the Suez Canal at night. In order that all parts of the ship may be thoroughly examined after cargo has been discharged, she will be provided with a number of portable lamps. The cabin, forecastle and petty officers rooms will be all heated by steam so as to avoid any risk of fire. The accommodation of captain, officers, and the saloon are under the shade deck, the engineers' rooms in a large house on deck aft, and the crew forward. A patent steam steering gear will be fitted amidships and screw gear aft, patent steam windlass by Emerson, Walker & Co., two donkey boilers, patent stockless anchors, and in addition to all the necessary fittings and outfit for the oil trade, there will be a complete outfit for working general cargoes, including six steam winches. Three masts will be fitted and neatly rigged, and awnings all fore and aft for the Eastern climate. Great care has been taken to ensure strong and sound work. The rivetting is closely spaced in shell plating, decks and bulkheads, and in order to reduce as far as possible the number of joints in way of the oil tanks, most of the shell plates are nearly 30 ft. long. The vessel will be fitted with a very powerful set of triple-expansion engines of the well-known type manufactured by the Central Marine Engine Works of Wm. Gray & Co., Limited. The cylinders will be 26 in., 42 in., and 70 in. diameter respectively, and of 45 in. stroke. An extra large amount of boiler power also is provided in the shape of three large single-ended boilers working at a pressure of 160 lbs. per square inch. Increased safety is ensured by placing two of the boilers with their backs towards the cofferdam, removing the heat of the stokehold a considerable distance from the bulkheads. The engines are capable of driving the ship at a high rate of speed when loaded, and are furnished with all the latest improvements. The engine room contains also one of Mudd's new patent feedwater evaporators, which is designed on a plan greatly facilitating cleansing and examination. The vessel and machinery have been built under the superintendence of Messrs. Flannery, Baggalay & Johnson, of London. The ceremony of naming the steamer *Bullmouth* was gracefully performed by Miss Winifred Baines, of West Hartlepool.

Capac.—On September 12th there was launched by Messrs. J. L. Thompson & Sons, at Sunderland, a steel screw steamer, built to the order of the New York and Pacific Steamship Co., Limited. The vessel is of the spar-deck type, and is of the following dimensions, viz.:—Length, 334 ft.; breadth, 42 ft. 6 in.; depth, 28 ft. 6 in., and has been built under special survey for Lloyd's highest classification. The engines, by Mr. John Dickinson, are of the triple-expansion type, having cylinders 24½ in., 40 in., and 66 in. diameter respectively, with a stroke of 45 in. The vessel was named the *Capac*.

Chickahominy.—On Tuesday, September 12th, Messrs. Furness, Withy & Co., Limited, launched from Middleton Shipyard, Hartlepool, a fine steel screw steamer, built to the order of the Chesapeake and Ohio Steamship Co., Limited, London, for the general cargo and cattle trade. The vessel has two iron decks laid all fore and aft with a shade deck above. To get better facilities in the lower hold for stowing cargo, and to give rigidity at the bilges the vessel is built on the web frame system with the builder's patent intercostal arrangement. The whole of the main framing is of strong sectional material, so that the top sides are as strong as any other portion. This sectional framing is most efficiently backed up, more especially at the upper deck, by extra strong plating, all the sheer-strake plates, stringer plates, &c., are increased in width and thickness, and so that none of the butts of shell plating should come near any gangways, ports, or other openings, a large number of very long shell plates have been worked into the vessel. In her construction the desire has been to gain strength by dispensing with as many riveted joints as possible by the use of sectional material, long plates, and extensive cold flanging. The main and fore holds are divided by iron watertight bulkheads efficiently stiffened by iron longitudinal grain divisions. There are no sluices through these bulkheads, and should the vessel be damaged by collision in any of these compartments it is anticipated that the efficient pumping arrangements will prevent her from sinking, and from calculations made by the builders, even should two of these compartments be open to to the sea she will continue to float. She has cellular double bottom all fore and aft for water ballast, and the after peak is also available for a ballast tank. The whole of the deck erections, &c., are of iron. The cattle will be carried on two decks with portable hinged fittings, so that on the return voyage from Europe the cattle space can be available for carrying cargo. The whole arrangement for the shipping and transhipping of cattle and cargo has been done under the supervision of Mr. G. McFarlane and Captain Manley. She is fitted with six large steam winches, double derricks, multitubular donkey boiler and patent stockless anchors housing into hawse pipes. The steam steering gear is fitted aft controlled from amidships, there is also a stand-by gear aft. She will be rigged as a pole-masted schooner. The masts are telescopic, so that if necessary the vessel can enter the Manchester Canal and under bridges in tidal rivers. The housing of the crew is under the shade deck, thus affording protection during heavy weather whilst attending to the cattle. Most efficient life-saving appliances are fitted, and all the boats are supplied with patent disengaging gear. The accommodation for the captain, passengers, and officers is fitted up in polished hardwood, with beautifully hand-painted panels, executed in a very effective style by the decorative staff of ladies employed by the firm, and the cabin presents an elegant and chaste appearance. The vessel will be fitted with triple-expansion engines by the Central Marine Engine Works, West Hartlepool, and it is anticipated a sea speed of 12 knots will be easily obtained. On leaving the ways, the vessel was gracefully christened *Chickahominy* by Mrs. E. S. Booth, of Boston, U.S.A.

Zenobia.—On September 14th the *Zenobia*, the latest addition to the Grimsby fleet of steam trawlers, was launched from the yard of Earle's Shipbuilding and Engineering Co., Limited, Hull. The *Zenobia* is an iron vessel 100 ft. long, 20 ft. 6 in. beam, and 11 ft. depth of hold. The engines are of the triple-compound type.

LAUNCHES—Scotch.

Kate.—On August 23rd, Messrs. J. M'Arthur & Co., launched from their shipyard at Paisley a handsomely modelled double-ended paddle-steamer named *Kate*, which has been built by them to the order of the Penarth Steam Ferry Co., of Cardiff. The *Kate* has been built under Board of Trade supervision for passenger certificate, and has a full outfit of life-saving appliances. She has deck saloons forward and aft, full promenade deck, and the usual side-houses, all of which are to be finished in a comfortable and tasteful manner. Engines to propel the steamer at a high rate of speed are now being fitted on board by Messrs. Bow, M'Lachlan & Co., of Paisley.

Gowan.—On August 26th there was launched by Messrs. Stevenson & Asher, at Macduff, a fishing boat of the Zulu carvel build, and of the following dimensions:—Length of keel, 51 ft.; over stems, 56 ft.; breadth of beam, 18 ft. 4 in.; and depth of hold, 5 ft. 5 in. Her owner is Mr. William Crawford, fisherman, Banff, who has named her the *Gowan*.

Marmion.—On August 28th there was launched from the shipbuilding yard of Messrs. Scott & Sons, Bowling, a finely-modelled screw-steamer, 140 ft. by 24 ft., by 10 ft. 6 in., built to the order of Messrs. William M'Lachlan & Co., Bridgegate, Glasgow, for their fish trade. The engines, which are compound surface-condensing, are being supplied by Messrs. Muir & Houston, Glasgow. On moving into the water the steamer was named *Marmion* by Miss Isabella M'Lachlan, Woodholm, Langside.

Marie Haelfeld.—On August 28th Messrs. Russell & Co. launched from their Greenock yard a three-masted sailing ship named the *Marie Haelfeld* for F. C. Pfluger & Co., Bremen. Dimensions:—Length, 246 ft.; breadth, 37 ft. 6 in.; depth, 22 ft. 6 in.; and of 2,850 tons deadweight. After fitting out she will load at Liverpool for Honolulu, and will be in command of Captain Kruse, who supervised the construction. A 6,000-ton steamer is to be laid on the vacated berth.

Princess Melita.—On August 28th Messrs. John Scott & Co., Abden Shipyard, Kinghorn, launched a magnificent steam yacht to the order of a firm in Malta. She is sumptuously fitted up, and on leaving the ways was christened the *Princess Melita* by Miss Crawford, daughter of one of the builders. As she was launched fully equipped and with steam up, she at once proceeded on her trial trip.

Tejo.—On August 28th Messrs. Murdoch & Murray, Port-Glasgow, launched from their shipbuilding yard a steel twin-screw steamer for passenger traffic on the river Amazon, of the following dimensions, viz.:—140 ft. by 24 ft., by 16 ft. deep, sponsoned to 30 ft. wide at main deck. The whole of the main deck is fitted with cattle stalls. On the promenade deck is placed a large teak deckhouse, with accommodation for 36 first-class passengers, with iron folding beds, bath-rooms, and wash basins, supplied by tank connected to donkey engine. The dining-tables are placed on promenade deck under shade deck. The whole of the fittings are electro-plated, and the vessel has been arranged and inspected by Captain Gomes, and will be supplied with two sets of triple-expansion engines by Messrs. Lees, Anderson, & Co., Glasgow. Electric light will be supplied by Messrs. Holmes & Co., of Newcastle. The engineering department is under the superintendence of Mr. Kerr, engineer, who will go out in the vessel. On leaving the ways the vessel was named the *Tejo* by Mrs. Gomes.

Blairmore.—On August 29th there was launched from the shipbuilding yard of Messrs. Archibald M'Millan & Son, Limited, Dumbarton, a handsome steel sailing ship of 1,950 tons, which has been built to the order of Messrs. Thomas Dickie & Co., Glasgow. On leaving the ways she was named the *Blairmore*, the christening ceremony being performed by Mrs. Wm. Douglas, Thornbank, Blairmore. The vessel on completion, will proceed to Greenock to load for the River Plate. She will be commanded by Captain Caw.

Newfield.—On August 29th there was launched from the ship building yard of Messrs. Alex. Stephen & Sons, Dundee, a steel barque, built to the order of Messrs. Brownells & Co., Liverpool. The vessel, which has been named the *Newfield*, is of the following dimensions:—Length, 243 ft.; breadth, 27 ft.; depth, 23 ft.; depth of hold, 21 ft., 6 in. She will carry about 2,200 tons deadweight.

[illegible]a.—On August 30th, Messrs. David & William [illegible]n & Co., launched at Partick a large four-masted barque, built for Messrs. J. Hardie & Co., Glasgow. Dimensions:—Length, 292 ft.; breadth, 43 ft.; depth, 24 ft. The vessel, which was named the *Corunna*, has been built to the highest class at Lloyd's, and will be commanded by Captain Robinsons.

Laurelbank.—On August 31st Messrs. Russell & Co. launched from Kingston Yard, Port-Glasgow, a four-masted barque, for Messrs. Andrew Weir & Co., Glasgow, of 2,250 tons register, to carry 3,800 tons deadweight. Dimensions:—Length, 283 ft.; breadth, 43 ft.; depth, 24 ft. 6 in. The ceremony of naming the vessel *Laurelbank* was gracefully performed by Mrs. Graham, Auchenlea, Pollokshields. The vessel was towed to Greenock to fit out in the James Watt Dock.

Steel Screw Lighter.—On September 1st Mr. D. M. Cumming, Blackhill Dock, Glasgow, launched from his yard a steel screw-lighter, 67 ft. by 13 ft. 6 in. by 6 ft. 6 in. moulded. The engines which are being supplied by Messrs. Hall-Brown, Buttery & Co., Govan, are of the diagonal high-pressure type, having cylinders 8 in. diameter by 12 in. stroke.

Oberon.—On September 4th Messrs. Russell & Co. launched from their Kingston Shipbuilding Yard, Port-Glasgow, a four-masted barquentine of about 1,000 tons net register, to carry 1,850 tons deadweight, for Captain Fairlie, Glasgow. The dimensions are:—Length, 210 ft.; breadth, 35 ft. 6 in.; depth, 19 ft. 6 in. The vessel on leaving the ways was named *Oberon*, and after the launch was towed to James Watt Dock to fit out.

Mary Stewart.—On September 5th Messrs. A. Hall & Co. launched from their yard at Aberdeen the steel steam trawler *Mary Stewart*, built for Mr. Henry Rippon, Hull. The vessel is 105 ft. long, 20 ft. 9 in. beam, and 11 ft. 4 in. deep.

Centesima.—On September 11th there was launched from the shipbuilding yard of Messrs. R. Williamson & Son, at Workington, a fine four-masted barque, the largest yet built on the Solway. This being the hundredth vessel built by the firm she was named the *Centesima*. Her dimensions are as follows:—Length over all, 321 ft.; Lloyd's dimensions, 296 ft. by 42·0 ft. by 28·5 ft.; gross tonnage, 2,961 tons; net, 2,798 tons; displacement at load line, about 6,400 tons; and will carry a deadweight cargo of about 4,600 tons; fitted with poop aft, large bridge amidships, two steam winches and windlass; built of steel with steel masts and yards. The *Centesima* is chartered to Bombay with a cargo of coal from Newport, Mon., and will be commanded by Captain Peters, late of the *Silvercrag*, another of Messrs. Williamson's ships.

Port Elgin.—On September 11th Messrs. Russell & Co. launched at Greenock a three-masted sailing ship of 1,860 tons register, to carry 2,780 tons deadweight, and of the following dimensions:—Length, 260 ft.; breadth, 38 ft. 2 in.; and depth, 22 ft. 9 in. The new vessel, which was named *Port Elgin*, has been built to the order of Messrs. Crawford & Rowat, shipowners, Glasgow.

Sailing Vessel.—On September 11th Messrs. Russell & Co. Greenock, launched a sailing ship of 2,780 tons deadweight capacity for Messrs. Crawford & Rowatt, Glasgow, and is intended for the general trade. She is 260 ft. long, 32 ft. broad, and 22 ft. deep, and is fitted with Lambie's patent bulwark port-door, and Mill's patent pumps. She has been superintended during construction by John Wright, Glasgow, and will be commanded by Captain Rennie.

Hercules, Cetus, and Corvus.—On September 12th there were launched by Messrs. Mackie & Thomson, Govan, the *Hercules*, *Cetus*, and *Corvus*, three trawlers of about 150 tons each, built to the order of Messrs. Muir & Houston, Kinning Park, for the Grimsby and North Sea Steam Trawling Co. The first of the three is of the well type, and the others are ordinary trawlers. Messrs. Muir & Houston supply the machinery.

Saxon.—On September 12th Messrs. Russell & Co. launched from Kingston Yard, Port-Glasgow, a three-masted barque named *Saxon*, of 1,500 tons net register, to carry 2,750 tons dead weight. Dimensions:—Length, 246 ft.; breadth, 37 ft. 6 in.; depth, 22 ft. 4 in. The owner is Mr. D. M'Gillivray, Greenock, and the *Saxon* is sister ship to the *Gael*, built by Messrs. Russell & Co., a few months ago for the same owner.

Shenandoah.—On Thursday afternoon, September 14th, a splendid steel screw-steamer, of about 4,000 tons gross and 600 N.H.P. was launched by Messrs. Alex. Stephen & Sons, at Linthouse. She has been built to the order of the Chesapeake

and Ohio Steamship Co., Limited, of London, for their cattle and cargo trade between Newport News and this country, and was gracefully named the *Shenandoah*, by Miss Dorothy Mac Kenzie, daughter of Colin J. MacKenzie, Esq., of Portmore. Lord Lieutenant of Peeblesshire and one of the directors of the company. The *Shenandoah* is a sister ship to the *Rappahannock*, launched by Messrs. Stephen in the end of July, for the same owners, and which has since made a very successful maiden voyage to Newport News.

Jurua.—On September 23rd there was launched from the yard of Messrs. Murdoch & Murray, Port-Glasgow, a finely-modelled steel twin-screw steamer, of the following dimensions:—150 ft. by 33 ft. by 17·6 ft. deep. The vessel has been specially designed for passenger and cargo service on the river Amazon, and makes the fifth recently built by the firm for this trade. The engineers' rooms, galley, and store-rooms are placed on the main deck amidships, and at the forward end are the forecastle, second-class state-rooms, lavatories, &c. Cattle stalling is provided for about 160 animals. The winches for working the cargo hatches are also on this deck, as also the cage-like entrance to the engine-room. A neat staircase leads to the promenade deck. On this deck, in the centre, are placed the captain's, mate's, and purser's rooms, whilst ranged along both sides are the first-class state-rooms for 40 passengers, and also ample lavatory and shower-bath accommodation. The steering-gear is placed, after the American fashion, in the extreme fore end without obstruction. Over all is placed a light sun-deck for protection against the extreme heat and heavy rains of the tropics, and side screens will also be fitted all fore and aft. From the shade-deck hammocks will be slung for passengers in excess of state-rooms. A feature of the vessel is the exclusive use of teak wood. As the vessel left the ways she was named *Jurua*, and was at once taken in tow to Greenock to be supplied by Messrs. Kincaid & Co., Limited, with a double set of powerful triple-expansion engines to indicate a large H.P., and a good speed is looked for. The ship and engines are constructed to Lloyd's special survey, and also to the superintendence of Mr. Theodora Giese.

Eagle.—Messrs. Scott & Sons have launched from their building-yard at Bowling a screw steamer named *Eagle*, built to the order of Messrs. John Milne & Sons, Montrose, for their coasting trade. The dimensions of the vessel are 66 ft. by 18 ft. 6 in. by 8 ft. 6 in., and she will be fitted with compound surface condensing engines by Messrs. Ross & Duncan, Govan.

LAUNCHES—American.

Priscilla.—On August 10th there was launched from the yard of the Delaware River Iron Shipbuilding and Engine Works, Chester, Pa., U.S.A., the new passenger and cargo steamer *Priscilla*, built for the Old Colony Steamboat Co. The vessel is 440 ft. 6 in. long, 52 ft. 6 in. beam, with a mean draught of 12 ft. Motive power will be supplied by a set of compound double-inclined four-cylinder engines constructed by Messrs. W. & A. Fletcher & Co., Hoboken, N.J., U.S.A., the diameter of the cylinders being 51 in. and 95 in., by 132 in. stroke.

Minneapolis.—On August 12th Messrs. Cramp launched from their yard at Philadelphia the protected cruiser *Minneapolis*, built for the United States Government. The vessel is 412 ft. long, 58 ft. beam, and 22 ft. 6 in. deep. Motive power will be supplied by engines of 21,000 H.P., by which a speed of 21 knots is expected to be attained. The armament will comprise one 8 in. breech loading gun, two 6 in. quick-firing guns, eight 4 in. ditto, twelve 6-pounder ditto, four 1-pounder ditto, and four Gatling guns.

Columbia.—On August 23rd Messrs. Charles Hillman & Co. launched from their yard at Philadelphia, Pa., U.S.A., the steel steam yacht *Columbia*, which they have built on account of Messrs. Cramp for Mr. J. Harvey Ladew, New York. The vessel is 180 ft. long, 22 ft. beam, and 15 ft. deep. Motive power will be supplied by a set of triple-expansion engines of 1,800 H.P., by which a speed of 18 knots is expected to be attained.

Centurion.—On August 30th Messrs. F. W. Wheeler & Co. launched from their yard at West Bay City, Michigan, U.S.A., the steel steamer *Centurion*, built for the Hopkins Transportation Co. The vessel is 378 ft. 6 in. long, 45 ft. 3 in. beam, and 26 ft. deep. Motive power will be supplied by a set of triple-expansion engines, having cylinders 23 in., 37½ in., and 63 in. diameter, by 44 in. stroke.

George B. Owen.—There was recently launched from the yard of Captain Davidson, at West Bay City, Mich., U.S.A., the steel schooner *George B. Owen*, built for the Ketcham Steamship Co., Chicago. The vessel is 205 ft. long, 34 ft. 6 in. beam, with a draught of 14 ft.

Laval.—There was recently launched from the yard of Messrs. Walter & Sons, at Hull, Ontario, the dredger *Laval*, built for the Department of Public Works. The vessel can dredge to a depth of 50 ft.

Yukon.—There was recently launched from the yard of Messrs. F. W. Wheeler & Co., West Bay City, Mich., U.S.A., the four-masted schooner *Yukon*, built for the Wilson Transit Co. The vessel is 270 ft. long, 42 ft. beam, and 20 ft. deep.

LAUNCH—Irish.

Wazzan.—On September 16th the steamer *Wazzan* was launched by Messrs. MacIlwaine & MacColl, Limited, at Belfast. This steamer has been built for the Mersey Steamship Co., of which company the managers are Messrs. Forwood Bros. The *Wazzan* is 242 ft. by 34 ft. by 19 ft. 6 in. The machinery is of the builders' special type, having cylinders 19½, 32½, and 54 in. diameter, by 39 in. stroke.

LAUNCH—Italian.

Elba.—On August 12th there was launched at Castellamare, Italy, the deck-protected cruiser *Elba*, built for the Italian Government. The vessel is 272 ft. long, 41 ft. 7 in. beam, and 15 ft. 9 in. deep. Motive power will be supplied by two sets of horizontal triple-expansion engines intended to indicate 4,000 H.P. under natural, and 6,500 H.P. under forced draught. The armament will comprise four 152 mm. quick-firing guns, six 12 cm. quick-firing guns, six 57 mm. quick-firing guns and four torpedo-tubes.

LAUNCHES—French.

D'Iberville.—On August 26th, the torpedo cruiser *D'Iberville* was launched at St. Nazaire, France. This vessel has been built from designs by M. de Bussy for the French Government, and as the contract for her construction was fixed on 26th August, 1891, she has been just two years under construction. The vessel is of a new type, and measures 262·5 ft. in length, by 27 ft. in breadth, with a displacement of 925 tons on a mean draught of water of 11 ft. 2 in. The propelling machinery is intended to develop 5,000 H.P., at about 265 revolutions per minute, and the estimated speed is 21·5 knots. The boilers and magazines are protected by a steel deck ·65 in. thick. A powerful armament will be provided, including one 4 in. quick-firing gun, placed in the bow; three 2·5 in. quick-firing guns; four 1·5 in. machine guns; and four torpedo-launching tubes.

Lansquenet.—On August 26th the first-class torpedo boat *Lansquenet*, built for the French Government, left the building slip at Nantes. Between the perpendiculars the vessel measures 164 ft., and is to be fitted with powerful machinery, driving twin-screws, to attain an estimated speed of 26 knots. The contract for her construction was settled on 23rd March, 1892, the price being fixed at £21,400.

Bugeaud.—On August 28th the second-class deck-protected cruiser *Bugeaud*, built for the French Government, was launched at Cherbourg. The vessel is 308 ft. long, 43 ft. 6 in. beam, and 20 ft. 9 in. deep, with a displacement of 3,720 tons. Motive power will be supplied by engines of 9,000 H.P., by which a speed of 19½ knots is expected to be obtained. The armament of the vessel will comprise six 6½ in. guns, four 4 in quick-firing guns, twenty machine-guns, and six torpedo-tubes.

LAUNCHES—German.

Jeanette Woermann.—On August 9th Messrs. Blohm & Voss launched from their yard at Hamburg the steamer *Jeanette Woermann*, built for the African Steam Shipping Company.

Albatros.—On August 17th, Messrs. Möller & Holberg launched from their yard at Stettin the screw cargo steamer, *Albatros*, built for the Norddeutscher Lloyd, Bremen.

Torpedo Boat.—On August 17th there was launched from the yard of the Germania Shipbuilding Company, at Kiel, a torpedo boat, 186 ft. 8 in. long, built for the Turkish Government.

Humor.—On August 22nd Messrs. Jannsen & Schmilinsky launched from their yard at Hamburg the small steamer *Humor*. The vessel, which is built of steel, is 65 ft. long, 16 ft. 6 in. beam, and 9 ft. 6 in. deep. Motive power is supplied by a set of triple-expansion engines of 200 H.P.

Georg Mahn.—On September 5th there was launched from the yard of the Neptune Shipbuilding Co., Rostock, Germany, the screw cargo-steamer *Georg Mahn*, built for Herr H. Podens, Wismar. The vessel, which is built of the best English steel, is 233 ft. long, 34 ft. 6 in. beam, and 14 ft. deep. Motive power will be supplied by a set of triple-expansion engines of 400 H.P.

TRIAL TRIPS.

Manhattan.—On August 26th the s.s. *Manhattan*, one of the most successful of the oil tank steamers which cross the Atlantic, after a complete overhaul at the hands of Messrs. D. J. Dunlop & Co., Inch Works, Port-Glasgow, went down the river for her trial trip before proceeding to New York. There was a numerous company on board, including Messrs. D. J. Dunlop (the builder), A. Blair, J. D. Jamieson, Mrs. J. D. Jamieson, D. Houston, R. Rodger, M. J. Paul, J. Todd, Captain M'Bride, Chief-Officer Miles, of the *Potomac*, &c. After adjusting compasses at the Gareloch, the *Manhattan* proceeded down channel, and on the mile made a speed of over 12 knots, which was considered highly satisfactory. The *Manhattan* sailed for Philadelphia in the evening, and will there load petroleum in bulk. Her seamen were engaged in Greenock at £4 5s. per month, with the usual advance.

Olive.—The steel screw steamer *Olive*, which has been built to the order of the Glasgow, Dublin, and Londonderry Steam Packet Co., went on a trial cruise on August 29th round the Isle of Arran. The vessel, which was recently launched, is 1,114 tons gross, 260 ft. long, 33 ft. broad, and 16 ft. 6 in. deep. She has been built to Lloyd's highest class, but the scantlings are considerably in excess of the requirements. The regulations of the Board of Trade for a passenger certificate are also complied with. The vessel has been specially designed for the Irish Channel trade, and has been fitted up to carry 100 first-class, 700 steerage passengers, and about 800 cattle. The accommodation for first-class passengers, which is in the poop and deck-house, consists of dining-saloon and state-rooms, ladies' and gentlemen's cabins, and smoke-room. The dining-saloon is a handsome apartment, in polished bird's-eye maple and oak, and morocco leather. The state-rooms are large and well equipped. All the berths have wire mattresses, and the state-rooms communicate with the pantry by means of electric bells. Three of the state-rooms are fitted in the poop deck-house. They are of exceptional size, and are entered by a tiled passage. The companion and stairway are of polished teak, and are forward of these rooms in the same house. The smoking-room is in a house at the fore-end of the bridge deck; it is a large apartment, finished in walnut and upholstered in morocco. The arrangements for the transport of cattle are most complete. All parts of the main deck that can be made use of without detriment to the passenger accommodation are fitted up with cattle and horse stalls, and the whole of the 'tween decks are similarly arranged. The ventilation of these spaces has been made a special feature of the vessel. In addition to a thorough system of ordinary ventilation, a complete installation of artificial ventilation by means of fans has been introduced. By this means the air in all the cattle spaces can be kept perfectly sweet. The vessel has an installation of electric light fitted up in the saloons, state-rooms, crews' and steerage quarters, engine-room and deck and cargo hatches. A set of triple-compound engines of 2,500 H.P., with the latest appliances for economical working, have been supplied by the builders. The cylinders of the main engines are 26 in., 42 in., and 68½ in. in diameter, and the stroke 45 in. At a trial recently over the measured mile, the vessel attained a speed of 15¼ knots an hour, the engines working with the utmost smoothness, and to the entire satisfaction both of the owners and builders. The engines were designed by Mr. William Laing, who superintended the work during the construction of the vessel. On the invitation of the owners, a number of ladies and gentlemen joined the steamer at Gourock, travelling from the city in saloon carriages attached to the 8.46 train. Amongst those present were: Mr. George M'Lellan, Mr. Louis M'Lellan, Miss M'Lellan, Mr. W. M'Connell, Mr. and Mrs. G. Turnbull, Mr., Mrs., and Miss Turner, Provost Black, Greenock; Colonel Matheson, Mr. and Mrs. Philipps, Londonderry; Mr. Hannah, Midland Railway Co.; Mr. Matthew, Caledonian Railway Co.; Mr. Marsters, East Coast Railway Co.; Mr. Andrew Henderson, Mr. William Jonathan Turnbull, Mr. William Martin, Mr. Pierson, Mr. Montgomery, Caledonian Railway, Greenock, and Mr. Anderson. A cruise of about 90 miles was accomplished in fairly good weather. Though the sky assumed a threatening aspect most of the day, happily the sun shone out at intervals, and very little rain fell. On the return journey dinner was served in the saloon—Mr. George M'Lellan presiding. After the toast of "The Queen" had been duly honoured, Colonel Matheson proposed "Success to the *Olive*, and to the Glasgow, Dublin, and Londonderry Steam Packet Co., Limited." In doing so he remarked that no words were required from him to impress upon them the beauty and the good qualities of the new steamer, because they would see for themselves what a fine piece of work it was. The company, he might mention, now possessed 11 ships, and were progressing rapidly. The latest addition, however, was the best. Mr. M'Lellan, with whose name the toast was coupled, said that their company was the largest steamship company in the world, and he thought they were the proud possessors of one of the newest and best ships afloat. He had much pleasure in submitting the toast, "Success to the Builders and Engineers." They had been very much indebted to Messrs. D. & W. Henderson for the kind of ships they got from them, and they had very good reason to be satisfied with the latest addition. Mr. Henderson, in replying, referred to the pleasant dealings his firm had had with the owners. They had built quite a number of vessels for them, and he trusted they would be able to get orders for more. The company returned to Glasgow by the 5.50 train from Greenock.

Roland.—On August 30th the large steel screw-steamer *Roland*, which has been built for the Norddeutscher Lloyd, of Bremen, by Messrs. W. G. Armstrong, Mitchell & Co., Limited, was taken out to sea for her trial trip. The *Roland* is the pioneer ship of one of the Norddeutscher Lloyd new departures, and is arranged for the transport of emigrants and cargo from Bremerhaven to New York. On the trial the *Roland* attained a speed of over 13 knots, which was considered extremely satisfactory; and the coal consumption, which was measured during five hours continuous running at 12·25 knots, came out at 1·5 lb. per I.H.P. per hour. The machinery was supplied by the Wallsend Slipway and Engineering Co., Limited, and worked well throughout. A somewhat novel feature in the machinery department is the sea ash-ejector.

St. Bernard.—On August 31st the steam trawler *St. Bernard*, said to be the largest vessel of the kind afloat, underwent her trial trip in the Firth of Forth. Built of steel by the Grangemouth Dockyard Co., to the order of Mr. James Muirhead, fish merchant, Edinburgh, and president of the local Fish Trade Association, the *St. Bernard* is in all respects a very fine trawler, and seems admirably adapted for the work in which she will be engaged on the East Coast. Her length is 117 ft., breadth 21 ft., and depth 12 ft., and she has been constructed, under special survey, to class 100 A1 at Lloyd's. She has been fitted by Messrs. Hutson & Son, Kelvinhaugh Engine Works, Glasgow, with compound surface condensing engines of 650 I.H.P., and has been provided with a powerful winch by Messrs. Good & Menzies, of Hull. Leaving Granton shortly after noon, with a large party of ladies and gentlemen on board, the *St. Bernard* made her way into the estuary under very disagreeable auspices, the wet and foggy weather greatly impeding the usual adjustment of the compasses. Later on, however, the rain ceased, and a fairly pleasant sail was experienced by the company. Following the running of the measured mile, which was accomplished at a speed of rather under 13 knots, luncheon was served. Subsequently the trawl was slipped overboard, but after an interval of half an hour there was no result. Granton was reached shortly before 9 o'clock in the evening, all seeming satisfied with the sea-going qualities of the vessel.

Fijian.—On September 2nd the steam trawler *Fijian*, which has been built for Grimsby owners, left the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesborough, for the customary trial trip, during which everything was found to work most satisfactorily, and the vessel proceeded to Grimsby. She is of the well-known and successful type of these builders, and is the sixth built by them for the same owners. The principal dimensions are:—Length, 107 ft. 8 in.; beam, 20 ft. 5 in.;

depth moulded, 11 ft. 8 in.; fitted with engines by the North-Eastern Marine Engineering Co., Limited, of Sunderland, the cylinders being 11 in., 17 in., and 28 in. by 21 in. stroke, with a large steel boiler working at 160 lbs. pressure. The vessel is fitted specially for the North Sea fishing trade, and her outfit includes all the latest improved appliances. She is of greater strength than required by Lloyd's for their highest class, and is double-rivetted throughout.

Rameses.—On September 2nd the steamship *Rameses*, built by Messrs. R. Napier & Sons, Govan, for the Moss Steamship Co., Liverpool, went on a trial trip in the Firth of Clyde. The vessel has been specially designed by Messrs. William Esplen & Son, Liverpool, for the company's Mediterranean service, and has been built under their inspection to class 100 A1 Lloyd's three-decked rule on the deep frame principle. The general dimensions are:—Length, between perpendiculars, 320 ft.; breadth, moulded, 38 ft.; depth, moulded, 24 ft. 7 in.; with a topgallant forecastle, long bridge-house and full poop. Superior accommodation has been provided in the fore part of the bridge-house for about 60 first-class passengers, and is fitted with the most modern appliances for their comfort; while the poop deck is constructed to accommodate about 20 second-class passengers. A deck-house on the bridge contains a large entrance hall and social room in polished oak, and a wide stair with handsome teak rails leads to the cabins on the main deck. The saloon is finished in wainscot oak, and the ceiling is relieved by gilt mouldings. The state-rooms, which are very roomy and comfortable, have polished mahogany fittings, wire-woven mattresses, and electric bells. The new vessel has a complete installation of electric lighting. The machinery consists of a set of triple-expansion engines and two single-ended boilers designed for a working pressure of 200 lbs., and have all the most recent improvements for efficiency and economy. On the invitation of the builders a party of gentlemen joined the steamer off Greenock, and several trials were run over the measured mile. The results were highly satisfactory both to owners and builders, a mean speed of 13¼ knots being obtained, equal to a knot more than the contract, without any trace of heating or priming. In the course of a short cruise after the trials, dinner was served in the saloon. Mr. James Hamilton occupied the chair, and among those present were Mr. William Moss (representing the Moss Steamship Co.), Mr. William Esplen (Liverpool), and Mr. John Esplen, Mr. James Hamilton and Mr. John Hamilton (the builders), Mr. William Sloan (Glasgow), Mr. Hedley Crane, and Mr. A. W. Baird. After the toast of "the Queen" had been duly honoured, the Chairman proposed "Success to the *Rameses*." In doing so he remarked that the name of the new vessel was a very old one. She was what they called an up-to-date ship, and they were quite satisfied from what they had seen of her that she would turn out satisfactory in every way. Wherever she went they were certain she would give a good account of herself. This was the first time they had had the pleasure of building a boat for the Moss Steamship Co., and it was the first connection they had had with Messrs. Esplen, who certainly shared with the builders any credit there might be in the job. The owners had altogether 14 ships in the fleet, and Mr. Moss had told him they had room for more. In concluding, he gave the toast of "The Moss Steamship Co." Mr. Moss, in responding, said that he was sure the *Rameses* would give satisfaction to everyone. He proposed "success to Messrs. R. Napier & Sons." Mr. John Hamilton, with whose name the toast was coupled, said that the builders had done their best to produce a good vessel. She would, he trusted, not only be a credit to the builders, but a source of considerable revenue to the owners. The weather was of the most delightful description, and the trip was thoroughly enjoyed.

Oolong.—On September 2nd the steel steamship *Oolong*, built by the London and Glasgow Engineering and Shipbuilding Co., Limited, belonging to the China Mutual S.N. Co., Limited, went down the Clyde and proceeded, after adjustment of compasses, to the measured mile, and ran that distance with and against the tide several times, the mean speed obtained being 13·3 knots, the engines working up to 85 revolutions, and indicating 2,400 H.P., everything working smoothly. There was an entire absence of hot bearings. The chairman of the Mutual Co., Mr. D. Reid; Mr. John Potter, managing director; Captain Hogg, marine superintendent; Mr. D. Meiklereid, engineer superintendent; Mr. C. E. Stromeyer, Lloyd's surveyor; and various other officials were present, and expressed their great satisfaction with the trials of both engines and ship (which had also been subjected to various evolutions under different degrees of helm). After the usual good greetings, &c., on such occasions, the ship returned to the Tail of the Bank, where she took in 300 tons of cargo, and left for Liverpool. The engines throughout the day were under the charge of Mr. Morison, engineering manager, and the ship under Mr. H. Boyd.

Potomac.—On September 4th and 5th the trials of the new oil-carrying steamer *Potomac* were carried out with the most complete success. This steamer has been constructed by Messrs. A. & J. Inglis, Pointhouse, for the Anglo-American Oil Co., of London and New York, under the the direction of Mr. John D. Jamieson, a member of the London board of that important concern, and is of the following dimensions, viz.:—Length, between perpendiculars, 345 ft.; beam, 44 ft.; depth to upper deck, 31 ft. 6 in.; and she is propelled by engines of about 3,000 I.H.P. Mr. Jamieson has made the construction and management of oil tank steamers a subject of the most profound and minute study, and from his long and close connection with the business of transporting oil across the ocean has accumulated a mass of information such as very few possess. He was early struck with the serious expenditure for repairs on the great majority of steamers built for that purpose—the importance of which may be estimated from the fact that it was made the subject of a special paper this year by the chief surveyor to Lloyd's—and resolved that if care and forethought in the construction could obviate the expense and delay caused by withdrawing vessels from service for extensive overhauls, nothing should be left undone by the builders that would conduce to the result he required. In the first vessels built for the company, fully four years ago, viz., the *Bayonne*, by Messrs. Ingles, and the *Manhattan*, by Messrs. Dunlop, of Port-Glasgow, it had been found that the trying work of the Atlantic passage has been thoroughly sustained, and in all that time not one single hot rivet has been put into either vessel. That is to say, the vessels have been made fit for service by the builders, and not by the underwriters, a distinction which many underwriters will no doubt appreciate. The specifications of the *Potomac* were drawn up with the advantage of the experience gained in the working of her predecessors, and if possible she is even a more nearly perfect ship than they. The speed of the *Potomac* was ascertained to be 13·05 knots, which indicates a sufficient margin of power to contend with winter gales in the North Atlantic, and at this speed no vibration was perceptible in the officers' saloon, where a select party of friends of the owners and builders assembled to dinner. The Anglo-American Co. have wisely made the comfort of their officers and crew a very important consideration, as for the successful running of these vessels a superior class of men is an absolute necessity. Consequently no inducement for good men to remain in the service is wanting, the ample space allotted to the ship's company being utilised in a manner which may be called luxurious, even compared with the most important steamers afloat. The *Potomac* sails for America under the command of Captain Leitch.

Mexican Prince.—On September 5th the new petroleum steamer, *Mexican Prince*, built by Messrs. C. S. Swan & Hunter, Wallsend, to the order of Mr. James Knott, left the Tyne on her official trial trip on the measured mile off Tynemouth. The new vessel measures 339 ft. in length, 41 ft. in breadth, with a moulded depth of 27 ft. 6 in. The steamer, which is the latest augmentation to Mr. Knott's Prince line of steamers, has been built under special survey, and has been placed on the highest class at Lloyd's and Bureau Veritas. The speciality of the ship is that she has been constructed so that either oil can be carried in bulk, or general cargo if required, improved machinery for the rapid stowage and discharge of cargo having been introduced. The danger hitherto incurred in the inflammable nature of an oil cargo has been minimised by a complete equipment of revolving fans, by which the accumulated gas is pumped from the tanks, and the danger of explosion obviated. Her engines have been built by Messrs. Blair & Co., Limited, Stockton-on-Tees, the dimensions of the cylinders being 23 in., 38 in., and 62½ in., with a stroke of 42 in. The pumping installation for the oil cargo was fitted by Messrs. H. Watson & Sons. Mr. James Knott and a number of his friends were on board, the builders being represented by Mr. G. B. Hunter. The trial proved eminently satisfactory, a speed of

11 knots being attained, the machinery working smoothly and without perceptible vibration. The vessel has been built under the supervision of Mr. M. C. James, and the machinery under the superintendence of Mr. John Trail.

Bourbon.—On September 9th the s.s. *Bourbon*, recently launched by Messrs. Charles Connell & Co., Whiteinch, and built to the order of Messrs. Hugh Evans & Co., Liverpool, for the Liverpool and Maranham Steamship Co., Limited, went on her trial trip. Her dimensions are;—260 ft. on the water line, by 35 ft., by 22 ft., measuring about 1,600 tons. Having a cut-water stem and fine lines, she presents a very graceful appearance. She is fitted in a very handsome manner for a limited number of first-class passengers, under bridge before boiler space, the engineers and officers being in wing houses under the bridge, and the petty officers, seamen, and firemen in poop. The vessel is lighted throughout with electric light, and is fitted up in a most efficient manner. Her engines, of the newest type, with cylinders 20 in., 33 in., 54 in., by 42 in. stroke, working pressure 175 lbs., have been made by Messrs. Dunsmuir & Jackson, Govan, and the whole vessel and machinery has been built to the designs and under the superintendence of Mr. G. S. Goodwin, Liverpool, and under the survey of Lloyd's, Board of Trade, and Bureau Veritas. After adjusting compasses and receiving the owners and friends on board, the vessel proceeded to the Skelmorlie mile, where, after a series of progressive trials, a maximum speed of about 13 knots was obtained with an I.H.P. of 1,570. Everything worked in a most satisfactory manner, and the vessel left for Liverpool the same day.

Kate.—On September 9th the paddle steamer *Kate*, recently launched by Jas. M'Arthur & Co., Paisley, and built by them for the Cardiff & Penarth Steam Ferry Co. Limited, Cardiff, for ferry traffic between Cardiff and Penarth, went on her trial trip. She is a finely modelled double-ended paddle steamer, to carry 300 passengers, and has a full outfit of life saving appliances. Deck houses are fitted forward and aft, with a full promenade deck and the usual side houses, all of which are finished in a tasteful and comfortable manner. The engines are of the compound surface-condensing type, with all the latest improvements, made by Bow, M'Lachlan & Co., Paisley. The vessel has been built under the superintendence of Mr. Thomas Shereff, Glasgow, and Board of Trade Survey. After taking on board the owners' representatives, the builders, and some friends, the steamer went on the measured mile, when a speed of 9¾ knots was obtained. The machinery working throughout with the greatest smoothness, there being an entire absence of vibration. The owners were represented by Mr. Shereff and Mr. Milne, of Thomas M'Laren & Co., Glasgow, who expressed their entire satisfaction at the trial of the steamer.

Tejo.—On September 9th the official trial trip of the s.s. *Tejo* took place under very favourable circumstances, both as to speed on the measured mile and six hours' continuous steaming. The vessel is a twin-screw steamer 140 ft. by 24 ft., sponsoned out to 30 ft. on the main deck, with promenade deck 7 ft. above main deck, and shade or sun deck 7 ft. above promenade deck. The main deck is fitted with cattle stalls, and accommodation for crew. On the promenade deck there is a large deck-house, ladies' cabin, engineers' and officers' accommodation, bathrooms, with shower bath, and all the requirements for passenger service on the river Amazon. The *Tejo* was built to the order of Captain Antonio Peters Gomes, of Para. The contract was with Messrs. Lees, Anderson & Co., engineers, Clyde Street, Glasgow, the hull department was built by Messrs. Murdoch & Murray, Port-Glasgow. After the trial, which was a pretty severe one, the owner expressed himself as being highly satisfied in every respect. There was a large company of ladies and gentlemen, 52 in all. At the dinner after the trial, Mr. Anderson (of Messrs. Lees, Anderson & Co.) proposed the toast of "The Owners," to which Captain Gomes replied, and proposed the prosperity of the builders and engineers; other toasts followed. The vessel ran up Loch Long to Arrochar, and arrived at Port-Glasgow about five o'clock, the large company being delighted with the day's proceedings. Messrs. H. Alexander & Son have contracted to deliver the vessel at Para, and have selected Captain Gordon to take command.

Lemgo.—September 13th was the day set apart for the trial trip of the steamship *Lemgo*, which has just been built by the Blyth Shipbuilding Co., Limited, to the order of Mr. William Holzapfel, Newcastle. A considerable number of ladies and gentlemen had assembled on board, but owing to the heavy gale which was blowing, it was deemed inadvisable to leave Blyth Harbour. At luncheon, however, which was provided in the cabin, the chair being occupied by Mr. T. Vaughan, chairman of the Blyth Shipbuilding Co., the toast of "Success to the *Lemgo*" was received with enthusiasm; and Mr. W. Holzapfel, in responding, expressed his fullest satisfaction with the manner in which the vessel had been turned out. The dimensions of the *Lemgo* are:—Length, 285 ft.; depth, 19 ft. 6 in.; and breadth, 38 ft. She is built to carry 3,200 tons on a draught of 18 ft. 3 in. The *Lemgo* has been engined by George Clark, Limited, Sunderland, the engines being triple-expansion, with cylinders of 21 in., 35 in., and 57 in. by 39 in. stroke.

Nile.—On September 13th the *Nile*, a steel-screw steamer of about 6,000 tons, built for the Royal Mail Steam Packet Co. by Messrs. James & George Thomson, Limited, Clydebank, went on her trial trip down the river. The vessel, which is the first of two Messrs. Thomson are building for the company is specially designed for the first-class mail and passenger service between Southampton, Brazil, and the River Plate. Her length between perpendiculars, is 420 ft.; breadth, 52 ft.; and depth (moulded), 35 ft. 5 in. On the main, upper, and promenade decks there is accommodation for 215 first-class and 36 second-class passengers, and on the main and lower decks for 350 emigrants. The main dining saloon, which is situated on the upper deck, immediately forward of the machinery, is a handsome apartment. It is upholstered in polished oak, besides being panelled in bas-relief on a gilt ground alternating with side lights. The music-room, situated immediately over the dining saloon, is panelled with satinwood and cedar, with an elegant stained glass skylight in the centre, underneath which is a large opening communicating with the lower saloon. It contains at the forward end an upright Bechstein piano with a satinwood frame in keeping with the decoration of the room. There is also an American organ in the dining saloon. The ladies' private saloon is situated immediately abaft the music saloon. The first-class state rooms are unusually large, and every appliance has been added to increase the comfort of passengers in a tropical climate. Each room is fitted with wire-wove beds and two folding lavatories, and has natural light and ventilation. The promenade deck is extensive, extending a length of 140 ft. amidships, having a shade or shelter deck over it, while arrangements are made for lighting it at night with ten incandescent electric lamps. At the after end of the promenade deck is situated the first-class smoking-room, a luxurious apartment, panelled in walnut, and furnished with marble-topped tables and electro-plate fittings. Some of Rees' Chocks, as supplied to the Board of Trade's s.s. *Ceylon* have been fitted. A select company assembled at the trial trip, including Mr. James and George Thomson, Captain Chapman, marine superintendent of the Royal Mail Co., and Mrs. and Mr. Walter Chapman; Captains Spooner and Buckler, also of the same company; Mr. Arthur, engineering superintendent of the company; Dr. Gilmour and Miss Gilmour; Mr. Mollison and Mr. Edwards, Lloyd's surveyors. The storm of wind and rain which prevailed in the Channel in the earlier part of the day prevented a start being made till well on in the afternoon, when the measured mile was run, the vessel attaining the high speed of 17 knots. The ship proceeded to Southampton the same day.

Coquet.—On Saturday morning, September 16th, the s.s. *Coquet* left the Cleveland Dockyard of her builders, Sir Raylton Dixon & Co., Middlesbrough, for the customary trial of machinery and the general working of the ship. This steamer is of the well-deck type, the principal dimensions being:—Length, 292 ft. 6 in.; beam, 40 ft. 6 in.; depth moulded, 22 ft. 1 in.; and she has a large deadweight capacity, with special arrangements for the carrying of large timber. The engines have been fitted by the North-Eastern Marine Engineering Co., Limited, of Wallsend-on-Tyne, the cylinders being 22 in., 36 in., and 58 in. by 39 in. stroke, with two large boilers working at 160 lbs. pressure. During the trials everything worked most satisfactorily, and the vessel afterwards proceeded to the Tyne to load.

Cayo Romano.—On September 16th the fine steel screw steamship *Cayo Romano*, built by Messrs. John Readhead & Sons, West Docks, South Shields, to the order of Messrs. Ernest Bigland & Co., London, had her trial trip off the Tyne. The vessel is of the spar-deck type, and of the following dimensions: Length, 316 ft.; breadth, 41 ft.; depth, moulded, 26 ft. 10 in., and is classed 100 A1 at Lloyd's. She is provided with triple-expansion engines, also built by Messrs. Readhead & Sons, having cylinders 24 in., 40 in., and 65 in. by 42 in. stroke, sup-

plied with steam from two large steel boilers, working at a pressure of 160 lb. per square inch. The trial was a highly successful one, and satisfactory to all concerned, a speed of 12 knots per hour being obtained over the measured mile. After adjusting compasses, the vessel proceeded for London to be placed on the loading berth. Among the company present were Mr. Ernest Bigland, managing owner; Mr. Barringer, superintendent engineer for the company; and Mr. Bradney, who superintended the construction of the vessel.

Orcadia.—On September 16th the wood screw fishing boat *Orcadia* left her moorings in the Tyne for her trial trip, when an average speed of 10 knots per hour was obtained. The vessel, which was built by Mr. J. Lindsay, of St. Anthony's, is of the following dimensions:—86 ft. between perpendiculars by 19 ft. breadth, by 10 ft. 9 in. depth. The engines, which were built by Messrs. Baird & Barnsley, Bull Ring Engine Works, are of the compound surface condensing type, having cylinders 14 in. and 29 in. diameter by 20 in. stroke, with a large multitubular boiler, working 120 lb. pressure. The vessel has been built to the order of Mr. J. H. Irvin.

Shillito.—On September 16th the steel screw steamer *Shillito* proceeded from the Wear on her trial trip. This vessel has been built by Messrs. John Priestman & Co., Sunderland, for Messrs. Hoggatt & Woodruff, Cardiff, and is of the following dimensions:—Length, 297 ft.; breadth, extreme, 39 ft. 9 in.; depth, moulded, 21 ft. 2 in. Her machinery has been fitted by Messrs. George Clark, Limited, Southwick, having cylinders 22 in., 36 in., and 59 in. diameter, with a stroke of 39 in. During the trial the engines worked with smoothness and regularity, the ship attaining a speed of over nine knots with the ship fully laden.

Liguria.—On September 21st the Pacific Steam Navigation Co.'s steamer *Liguria* went down the Mersey on her official trial trip. She has been lately lying up in the Sandon Dock, where Messrs. David Rollo & Sons have converted the engines and fitted her with new boilers. The cylinders have been replaced by three new ones on the triple-expansion arrangement, and are 33, 54, and 88 in. diameter respectively, the stroke remaining as before, 60 in. Each cylinder is fitted with a hard cast-iron liner, which also forms the jackets. The covers and bottoms of the cylinders are also jacketed, the supply steam being regulated by reducing valve, Auld's make. The drains from jackets pass into tanks regulated to show the water used. This arrangement is also fitted to the main steam at H.P. casing, also to the M.P. and L.P. casings, the condensed water being led direct to the feed tank, the supply from which is controlled by Weir's float arrangement. The pistons are of cast steel, and are fitted with compensating ring, carrying volute springs acting against the packing rings. Three new piston rods of mild steel have been fitted, the M.P. and L.P. having tail rods. The whole of the valve gearing has been removed, and an entirely new set of gearing has been fitted. The new gear is of much heavier design than the old, and is fitted, with very large wearing surfaces. The gear is the ordinary double eccentric double bar-link arrangement. It acts on the valve-spindles direct in the case of the H.P. piston valve. The double piston valve in M.P. cylinder is connected by strong crossheads working in large guides. The L.P. valve, which is a Thom's patent slide, is placed at the back of the engines, and actuated through a cast steel lever. A new propeller having four blades of manganese bronze, has been fitted. The main feed pumps have been replaced with new of suitable size and design, the pumps and chests being best gun metal. These are worked from the main engines, but two very powerful auxiliary feed donkey pumps are also fitted for boiler-feeding these pumps direct to the boilers, or through a Hocking's live steam feed heater. The pumps, heater, evaporator, auxiliary condenser, and tanks are all placed in the passage, through the bunker, between engine and boiler rooms. The main boilers, which are fully up to the Board of Trade requirements for a working pressure of 180 lbs., are four in number, and are built of steel, the boilers being 14 ft. 6 in. diameter by 17 ft. long, double-ended, having 24 of Foxe's patent corrugated furnaces. The whole of the floors, frames, and reverse bars were gutted out of the boiler space, and a double-bottom ballast tank for fresh water, built in four compartments, having a bilge well at each end. Each compartment is fitted with the usual sounding, filling, air and signal pipes. The *Liguria* left the Morpeth Dock at 7 a.m. and proceeded down the river. After adjusting compasses, she made the run from the Bar Lightship to the Skerries and back, the engines running 72 revolutions, and giving 4,564 average I.H.P. The run was highly satisfactory, the average speed of the steamer being 16½ knots.

Acme.—The new steel screw steamer *Acme*, built by Messrs W. Dobson & Co., at Low Walker-on-Tyne, to the order of Messrs. Newman, Dale & Co., of London, recently went for her official trial trip off the mouth of the Tyne. The machinery, which has been built by the North-Eastern Marine Engineering Co., Limited, Wallsend, consists of a set of triple-expansion engines, which worked throughout the trial in a most efficient manner, a mean speed of 10½ knots being attained.

Glengariff.—The *Glengariff* has lately completed a series of highly successful trials off the river Tyne. She is a steel screw steamer, 275 ft. by 35 ft., built by Messrs. Wigham, Richardson & Co., at their Neptune Works at Walker, near Newcastle-on-Tyne, to the order of the City of Cork Steam Packet Co., of Cork, with engines of the builders' own make and type. The *Glengariff* is rigged as a schooner, is fitted up for passengers, and has, besides, all the special cattle and other fittings required for the particular trade of the company, as well as the latest improved machinery and appliances for ensuring the quickest despatch and the most efficient handling of the vessel and her cargoes. She is a finely modelled vessel, and her appearance has not only given satisfaction to those more immediately concerned, but has also called for remark from many who have seen her passing up and down the river before and after her various trials. The passenger accommodation is worthy of special mention, her owners being disposed to lead rather than follow in the footsteps of others in this as in other directions. The first-class cabins are amidships. The dining-saloon is finished in oak and decorated stamped leather, the smoke-room is panelled in marble, and the other saloons are in polished hardwood. The music saloon, which is in dark polished mahogany decorated with marqueterie panels, is furnished with a piano by first-class makers. The cabin floors are of polished marble mosaic; and the principal saloons are lighted by artistically designed and ornamented stained glass domes. The deck and other staterooms are comfortably furnished, having spring mattresses to the beds and other conveniences, and the lavatory and bath arrangements are of the best and most improved type. The galley and pantry arrangements are also the most modern. Electric lighting is fitted throughout the vessel, and electric bells, telephones, and steam heating add to the comfort and convenience of passengers. The ash discharging is done through tubes leading direct from the stokeholes through the ship's side, and thus no doors being required the heat and smell from the engine-room and stokehole are kept quite away from the passengers, who have a fine promenade deck at either side of the saloon houses and casings. On the official trial trip the *Glengariff* was taken for a run from Tynemouth to the Coquet and back, a distance of about 40 knots, and the mean speed over the two runs was about 16¼ knots, a result gratifying to builders and owners alike. After the long run a series of progressive runs were made over the measured mile. The engines were not once stopped during these trials, and worked throughout without the slightest hitch or signs of heating. Capt. Simmelkiar, the commodore of the company's fleet, will take command of the new vessel, which will now proceed to Cork to take up her station in the passenger trade between Cork and Liverpool. On the trial trips the owners were represented by Major Lyons, chairman; Mr. de Foubert, secretary; and Mr. Calvert, engineer to the company.

Lucigen.—The trial trip has taken place of the tank steamer *Lucigen*, built at the Walker yard of Messrs. Sir W. G. Armstrong, Mitchell & Co., to the order of the Lucigen Steamship Co., Limited, Messrs. H. E. Moss & Co., of Liverpool, being the managing owners. A very successful series of runs were made on the measured mile, giving a mean speed of nearly 11·5 knots with a consumption of coal of 1·4 pounds per I.H.P. per hour, the ship being fully loaded. The *Lucigen* is 342 ft. long, 42 ft. 8 in. beam, and 29 ft. 6 in. deep. She is built on Swan's patent principle for the carriage of petroleum in bulk. The propelling machinery has been supplied by the Wallsend Slipway and Engineering Co., and has cylinders, 24 in, 40 in., and 64 in., with a stroke of 48 in., and two large single ended boilers. During the trial everything worked satisfactorily.

Marietta.—The steam yacht *Marietta*, constructed by Messrs. Pusey & Jones, Wilmington, Del., U.S.A., for Mr. H. B. Moore, president of the New York Lighterage and Transportation Co., was recently taken for her trial trip with successful results. The vessel is 113 ft. 2 in. long, 16 ft. beam, and 8 ft. 5 in. deep.

Motive power is supplied by a set of triple-expansion engines, constructed by Mr. J. W. Sullivan, New York, the cylinders being 10 in., 15 in., and 24 in. diameter by 15 in. stroke. At the trial a mean speed of 18 miles per hour under natural draught was attained.

Olimpia.—This boat, which has been built for Spanish owners by W. Harkess & Son, of Middlesbrough-on-Tees, has been taken from the builders' yard for her loaded trial on the measured mile. The dimensions of the vessel are :—160 ft. by 24 ft. 6 in. by 12 ft. 3 in. moulded. Engines by Messrs. Westgarth, English & Co., of Middlesbrough. Although a heavy sea was coming over the bows the speed was fully maintained; everything worked very smoothly and satisfactorily, and the vessel proceeded on her first voyage to Liverpool.

Wallsend.—The screw steamer *Wallsend*, constructed by Messrs. Wood, Skinner & Co., Bill Quay-on-Tyne, for Messrs. Burnett & Co., Newcastle-on-Tyne, was lately taken for her trial trip. The vessel is 210 ft. long, 30 ft. beam, and 14 ft. 6 in. deep. Motive power is supplied by a set of triple-expansion engines constructed by the North-Eastern Marine Engineering Co., Wallsend, the cylinders being 17 in., 28 in., and 46 in. diameter by 30 in. stroke. At the trial a mean speed of 11 knots was attained.

NOTES FROM THE WORLD'S FAIR.

(From our Special Correspondent.)

AN interesting controversy has been taking place between some of the government officials respecting the construction of the new gunboats authorized by a recent Act of Congress. According to information from Washington, the Attorney-General has dashed the hopes of the construction corps of the navy by ruling that the department cannot build the new gunboats of composite type. The question was submitted to him by Secretary Herbert whether he could lawfully contract for the construction of one or more of the light draught gunboats authorized by the act of March 3rd, 1893, on what is called the composite plan, the hull frames being of steel, covered by wood planking and sheathed with copper.

The Attorney-General says: "In my judgment the Act contemplates the construction of light draught protected gunboats of steel, and does not authorize the building of such gunboats of the composite plan."

So it appears that the new boats will have to be built of steel throughout, and without sheathing to protect them from the growth of marine vegetation, which involves frequent docking at great expense. The decision, however, will not delay the completion of the plans for the boats to any considerable extent, for the construction bureau had already prepared rough designs for vessels of all-steel type to meet the contingency.

When the ordnance department of the army began the work of designing new guns and mortars for the coast defence system, projected by the fortifications board, difficulty was experienced in securing reliable springs to take up the heavy recoil of the great 12-inch seacoast mortars, and after experiments they were obliged to turn to what is known as the Belleville spring, a French invention, consisting of a great number of dish-shaped steel disks secured on a spindle. This spring was very difficult of manufacture owing to the nicety of temper required.

Now, however, the bureau has found the desired spring in this country. A Pittsburg firm has submitted for trial a number of double-coiled springs that have passed the tests satisfactorily, and hereafter these springs will be used instead of the French spring in all of the 12-inch mortars.

The application of the new Harveyizing process to armour plate is difficult in the case of curved plates, but the ordnance bureau of the navy department has been informed that the Bethlehem Iron Works has just treated with success a curved plate 16 ft. by 7 in length and tapering from 12 in. to 6 in thickness, intended for the side armour for the *Maine*. The plate represents a lot of 492 tons of armour and upon its test depends the acceptance of that lot.

In connection with the World's Fair, the system of electric light buoys from Chicago Harbour to the steamboat pier at Jackson Park is being constructed under the direction of Commander John J. Brice, U.S.N., Inspector of the Ninth Lighthouse District. When completed the system will be in itself an extremely interesting exhibit, not only to sailors and electrical experts, but to every one who is curious about the workings of electricity. The first system of the kind was that laid in New York harbour, but compared to the Jackson Park line the former is a poor and primitive piece of work.

The system will consist of thirteen buoys, half-a-mile apart, each one surmounted by an incandescent light of 100 candle-power, and visible eight miles in clear weather. In times of heavy weather and fog no difficulty will be experienced by a pilot in picking out the next buoy when he has reached the first one, and each succeeding one in turn. As the buoys themselves will be painted red they will be plainly seen in the day time. They will be placed in the middle channel to the Fair, and mark what is known as "Fair way." They will be located in the centre of the channel, and vessels will be required to keep on their starboard side and at a distance of 100 yards so as to prevent fouling with them.

The current of 2,000 volts is communicated to the lamps by cables. These are two in number, and are called the main and auxiliary cables. The auxiliary cable starts from the end of the steamboat pier at the Fair grounds. A small house shelters the converter, which allows just enough current to pass into the cables to supply the lights. The power will be supplied by the Exposition. From the end of the pier about half a mile into the lake the first buoy will be placed. The buoys themselves are known technically as spar buoys, and consist of a long, round timber. Each is anchored to the bottom by anchors weighing one and one-half tons. The lamps will be about 12 ft. above water. The auxiliary cable enters the buoy near the bottom and runs up through the timber until it reaches the top, then turns and runs down the opposite side to the bottom and thence to the next buoy. Instead of connecting with the lamps as with an ordinary incandescent lamp a series coil taps the cable a short distance from the lamp. This runs across to the cable as it returns to the lake on the opposite of the spar, and allows only enough of the current to go into the lamp to produce 100 candle power.

At the end of the line, about half a mile off Van Buren Street Pier, the last buoy of the series will be located. After leaving the buoy the cable will connect with the main cable. This runs along the bottom of the lake along the line taken by the auxiliary cable and ends at the converter at the end of the pier at the Fair grounds, thus completing the circuit.

The entire length of the cable will be fourteen miles. At the deepest place it will be about 30 ft. from the surface of the water and in no case will it be near enough for vessels to become entangled in it. Following the curves of the channel established by the survey last year, the lights will at no point be over one and a quarter miles from the shore line. The main cable is about an inch in diameter. It was made to be very flexible, and on this account had seven separate wires for the core instead of one large one.

(To be continued.)

Reviews.

Transactions of the Hull and District Institution of Engineers and Naval Architects. Edited by G. H. Strong, Hon. Sec. Vol. vii. Hull: Gooddard & Son, 1893.

THE present issue of the transactions shows the society to be in a very thriving state. It also contains some very interesting papers. The first deals with the locomotives in use on the Hull & Barnesley Railway. This, though instructive, is not so directly connected with our subjects as are the remaining five. Some interesting experiences with the small vertical boilers at work on fishing boats, will give readers some food for reflection. The treatment which boilers receive at the hands of fishermen will cause wonder that there are not more disasters, but the real gist of the paper which was read by Mr. Wyllie, is the evidence regarding the wear and tear of these boilers owing to the forces of expansion and contraction at different temperatures. Mr. Dixon, of Earle's Shipbuilding & Engineering Co. gives an account of the vessels recently built for the Government by the firm, and of the trials to which the machinery was subjected before being accepted. The subsequent discussion dealt with the fact of the vibration set up when the machinery was running under forced draught. This seems entirely due to the way in which weight had been cut down in the specifications but the wisdom of doing so can be guaged by the admission that at the first trial of the *Pearl* there was a "sort of rocking motion in the engines athwart-

ship." In subsequent trials the engines "were steadied with properly fitted stays." It is thus that the daily press is kept supplied during the manœuvres with matter for report under its standing heading of "Another breakdown in the Navy," and it is thus that the hearts of contractors are broken in trying to get that lightness and strength which cannot be combined.

The remaining papers are on practical subjects, viz., hints on the determination of the size of ships in relation to deadweight capacity, speed and coal endurance, on the design and construction of marine boilers, (where the sense of the meeting was against the double ended variety), on steering of vessels and on the relation of the movement of the crank pin to the piston in fast running engines. The whole is well illustrated and the book is a proof, if proof were needed, that the shipbuilders and engineers of Hull are thoroughly up to date in the study of the arts and science which they pursue.

Steamships and their Machinery, from first to last. By J. C. Haldane. London: E. & F. Spon, 1893.

This is not the first time that Mr. Haldane has submitted a volume to the criticism of the public, and readers of *Engineering Popularly and Socially Considered*, will remember the peculiar and characteristic style of that book. The present work sees the characteristics still more marked, and the peculiarities are pronounced to too great an extent. The author follows the construction of vessels through every detail of the manufacture of the iron and the design of the vessel; he tells us of the building of an imaginary vessel, the *Veneedora*, which he follows through the shops and the shipyard; he gives us an account of the voyage of a mythical record breaker sailing to the Antipodes. Then the mythical ship (which sails under the name of *Centenarian*) is to meet with a terrible fate. She is to run on to an uncharted rock in the Southern Ocean. "Is there no one amongst the navigating staff of that crowded steamer who can give the commander the slightest hint that he is unconsciously running them all to swift and overwhelming destruction? . . . Cannot a passenger, startled from sleep by a vividly awful dream of impending danger, entreat the captain to change his course for five minutes? . . . The *Centenarian* is practically a lost ship, although apparently unsinkable. The shadow of death is over her, and before half an hour has rolled away a disaster unparalleled in the history of steam navigation will have occurred." Then he goes on to dwell on the various persons on board performing their allotted tasks for the last time, what time they think of the loved ones they are destined never to see again. After harrowing our feelings in this way for pages, he actually averts the final catastrophe and no accident occurs after all. The passenger's dream was quite unnecessary—which is as well, for we imagine that if all the passengers were to dream for entire voyages a captain of such a ship would not be worthy of his post if he attended to their visionary advice. The chief officer is destined to see his "intended" again, and the starboard fifth engineer will have every opportunity of admiring the thrust bearings which are not about to cease their task for ever. And yet, after averting the final crash, he tells us what would have been the result of the Board of Trade Inquiry which would have been held had the vessel been missing? The thing is too far-fetched in these details, and we feel it our duty to dwell on this point and emphasise it as much as possible, for in other respects the book is most admirable. It is well got up, well illustrated, and well written by a man who in every line shows that he thoroughly understands and delights in the subjects on which he writes.

Electric Light Fitting. By John W. Urquhart. Second Edition. London: Crosby Lockwood & Co. 1893.

As the author himself admits in the preface, the man who wants to read about electricity has a good many books to choose from. Yet he is right also in saying that many of the works that have been issued limit their possible readers by being largely given over to formulæ, the appreciation of which necessitates a knowledge of high mathematics. In the present volume then Mr. Urquhart aims at giving us a book which shall be useful to those who have to do with the practical work of making installations and of managing them when made.

Those of our readers who have read Mr. Urquhart's previous works will readily understand that the book is clearly and carefully written, and that it bears strong internal evidence of having been produced by a man thoroughly acquainted with the matters he deals with. To the marine engineer the full account of the installation on board the *City of New York* (now of course known as the *New York*) will be most interesting. It may be noted that in this ship electricity not only furnishes light throughout, but also drives the ventilating fans and works one of the ammonia pumps for refrigeration. The field which is thus opened to electric motors on shipboard, even in merchant ships, is very large, for the number of auxiliary engines seems to increase with every new liner. Another point in connection with this installation is the fact that in addition to the main dynamos in the engine-room there are a couple upstairs on the main deck. These take their steam from the auxiliary boilers on the same deck, and thus, in the event of anything happening in the engine-room to stop that source of light (as in fact did happen on board her sister on one memorable occasion), there would not be darkness to aggravate the alarm of the passengers.

We may add that the usefulness of the book is increased by a good index, and that it is throughout full of illustrations.

Patents for Inventions. Abridgments of Specifications. Class 122. Steam Engines (including details common to fluid pressure engines generally). Period, 1877-83. London: Patent Office, Sale Branch. 1893. Price 9d.

This abridgment is a wonderful compilation. When we regard its size and the style of its get-up, and then think of the practically nominal figure at which it is sold, we feel inclined to consider the Controller-General of Patents a public benefactor.

Its bulk, however, and the significant fact that it only covers a space of seven years, whilst the subdivision of classes is so great that this stands 122nd on the list, may fairly suggest some other reflections on the vast amount of time and thought and also of money expended in the attempt to improve our various mechanical appliances. The reason that these abridgments have been published is to aid inventors in their search as to the novelty of the design they wish to protect. We have often in this column reminded our readers that the Patent Office makes no pretence of helping the would-be patentee to discover whether his idea is novel or not. This work, however, with the abridgments in the illustrated official journal from 1884, will afford the inquirer a means of satisfying himself as to novelty as far as regards all existing patents.

The volume contains brief descriptions, with illustrations of something like 1,400 patents. Examination of the volume shows how much improvements in details of the steam engine are sought after. Little improvements they may seem—methods of improved lubrication, of economical valve gear, of more scientific packing of pistons and stuffing boxes, arrangements of more delicate governing. These seem often small matters, yet we see them connected with the names of the leading engineers of the day, and it is by attention to details that the efficiency of the steam engine is year by year gradually getting somewhat nearer its theoretical value. No one knows better than the marine engineer that it is attention to details which marks the difference between failure and success.

We feel sure that this will be a very useful and valuable aid to those interested in these matters, and will do something to remove the reproach that the British patent office takes the inventor's fee and leaves him to grope in the dark for information as to the novelty of his idea.

Miscellaneous.

Contract for Steel Tugs.—The Montrose Shipbuilding and Engineering Co., Limited, have contracted with Mr. Joseph Constant, London, to build three screw steel tugs, 69 ft. between perpendiculars, 16 ft. 3in. by 8 ft. 2 in. Engines, C.S.C., 14 in. and 28 ins. by 22 ins. stroke. To be fitted for the Thames traffic with all the latest improvements.

Silicate Cotton.—Mr. W. F. Snowdon, Side, Newcastle, has been appointed agent for the sale of "Silicate Cotton or Slagwool," in the North-Eastern district. This speciality is manufactured by a novel process from blast furnace slag, and being a capital non-conductor of heat, is admirably adapted for covering steam-pipes and boilers. The manufacturers, Messrs. J. C. Broadbent & Co., of Portland House, 73, Basinghall Street, London, being in a position to supply consumers promptly, and at low rates, are doing a flourishing business, and have just completed the fulfilment of an Admiralty order for about 45 tons.

The British cruiser *Melpomene*, which returned to Victoria, B.C., from the south on Monday, September 18th, steamed direct from Callao to Victoria, a distance of over 5,000 miles, in 20 days, without making a stop for coal. Officers of the navy consider this a noteworthy achievement, which has been seldom paralleled and never surpassed.

Chicago Exhibition Awards.—Amongst the awards made in respect to the exhibits in the section of the World's Fair devoted to vessels engaged in maritime, lake, and river navigation and transport, is one to Messrs. Wm. Simons & Co., of Renfrew, for their elevating platform ferry steamer, also their models of various descriptions of dredgers.

American Gunboats.—The United States Navy Department has issued advertisements for the construction of three gunboats, which are to be of 1,200 tons displacement, have triple-expansion engines, and be capable of attaining a speed of 15 knots per hour. They will be practically of the same type as the *Bennington* and the *Yorktown*, although somewhat smaller, and they are intended for service in Chinese waters. The department reserves the right to award a contract to any bidder, regardless whether or not the tender is the lowest submitted. This is done in order to make a more equitable distribution of the construction of warships among the shipyards of the United States.

Six-Rater Yacht.—There has just been finished at the works of Messrs. Simpson & Co., spindle makers, Rutherglen, a handsome 6-rater yacht, built from the design of Mr. G. L. Watson, and under the superintendence of Mr. M'Phee, manager of the works. The vessel measures 42 ft. over all; on the load-water-line, 31 ft.; 6 ft 4 in. beam; and she has a draught of 7 ft. The little vessel, which is named *Zerlina*, is fully painted and equipped, and will be conveyed to Glasgow Harbour and lowered into its native element by means of one of the steam cranes early next week.

Clyde Navigation.—The quarterly report of the engineer to the Clyde Navigation, Mr. James Deas, C.E., states that 498,180 cubic yards were dredged from the river, more than half of which was taken from the new Cessnock Docks. The construction of the walls of this dock is progressing satisfactorily, and over 6,000 lineal feet were completed at the date of the report. Into these walls there have been worked 41,845 cubic yards of rubble, 15,706 cubic feet of granite ashlar, 216,373 cubic feet of concrete ashlar, and 24,229 cubic feet of granite cope. The sheds for the docks are to be of two storeys, and out of a total of 1,156½ ft. sanctioned, 684½ ft. are in progress. A large graving dock is being constructed close to the entrance to the Cessnock Tidal Docks, and 101,397 cubic yards have been excavated in preparation for the construction.

Rates for Repairing Oil-Tank Vessels.—The executive of the United Boilermakers' and Iron Ship Builders' Society have issued the following notice to the members:—"Keeping in view the great risk and danger our members are exposed to in carrying on the work of repairs on oil-tank vessels, as well as the high class of workmanship required, for which it is very difficult to arrange satisfactory piece rates, we have decided that the minimum rates payable to our members shall be as follows:—Platers, 15s. per day; riveters and caulkers, 12s. 6d. per day; and holders-on, 10s. per day. These rates apply to all tank steamers in all parts of the United Kingdom. The members are expected to work at ordinary piecework speed, thereby ensuring to the repairer a fair return of labour for wages paid by him. These are to apply to all repairs, whether at the tanks, boilers, or elsewhere."

The New Harbour Works at Dover.—The work at the new harbour at Dover, the foundation stone of which was laid by the Prince of Wales a few weeks ago, is now progressing rapidly. Extensive machinery has been put down for making the concrete blocks which are to form the base of the submarine work. Each block weighs about 20 tons, and measures 10 cubic yards. These blocks will be made at the rate of 100 per week, and the work has already commenced. Several spans of the iron viaduct have been fixed in place, and it is expected that this portion of the work will be finished by the autumn of next year. The first set of blocks will be laid from an island stage which is being constructed in the bay, and will be set by divers using either the bell or the ordinary dress. Every effort is being made to push on the work, and with favourable weather it is expected that 1,500 ft. of the new projecting arm will be finished by the end of next year.

The Civil and Mechanical Engineers' Society visited, on September 22nd, the new improvement works of the London and India Docks Joint Committee at Blackwall, now in course of construction from the designs of Mr. H. F. Donaldson, M.I C.E. These works are of considerable importance, as on their completion vessels drawing 29 ft. will be able to enter the docks. The works consist of the enlargements of the old lock entrance from the Thames and of the two cuts that give communication between the Blackwall Basin and the Import and Export Docks. These cuts will be increased in width from 45 ft. to 60 ft., and increased in depth from 25 ft. to 30 ft. A new engine and pumping station will be built, the docks deepened, and a new swing bridge constructed. The party were shown over the works by the contractors' agent, Mr. A. Beale, the contractors being Messrs. Lucas & Aird. Among those present were the President of the society, Mr. R. Bolton, the hon. sec., Mr. E. H. G. Brewster, Mr. A. Wallheim, Mr. Millington, Mr. Spark, and Mr. Adams.

Coils for Refrigerating Plant.—Twenty large coils of wrought iron tubes have been delivered at Hebburn, for the s.s. *Perthshire*, which Messrs. Hawthorn, Leslie, & Co. are now building, and which is to be fitted with the most perfect form of refrigerating plant by the Linde British Refrigeration Co., Limited. of London. The coils were made by the well-known firm of Lloyd & Lloyd, of Birmingham, who make a speciality of this class of work, and these coils are decidedly the largest that have been manufactured in this country. Each coil measures 33 ft. long by 6 ft. high, and contains approximately 1,500 ft. of tube, in one continuous length, without a joint. They are made from wrought iron tubes of the very best quality, and tested before leaving the works to a very high pressure. Great care is necessary, not only in the manufacture, but also in the loading and carriage, and the railway company had to provide special trucks to enable them to pass through the tunnels, &c., and they also sent an inspector through with the train to ensure safe delivery. The coils formed quite a train-load themselves. A similar plant is in course of manufacture, and will shortly be delivered for a sister ship to the above, which is also being built in the Hebburn Shipbuilding Yard.

Improved Propeller Blades.—Messrs. Jessop & Sons have just manufactured a large propeller blade on the method patented by Mr. John Willis, of Attercliffe. Sea-going engineers and shipowners know that corrosion sets in very quickly upon the back of propeller blades, and to a greater extent in steel than in cast iron. Mr. Willis' invention consists in a coating of copper united to the casting. This is effected by the copper plate, properly bent to shape, being placed in and forming part of the mould into which the iron or steel is poured, with the result that the copper is firmly united by fusion to the iron or steel face. There was some doubt whether large propeller blades could be made on this principle, but the one just sent out by Messrs. Jessop has settled that point. It was made to the order of Messrs. Leyland & Co., the well-known shipowners of Liverpool, who are proposing to try the blade in one of their vessels. It is understood that the increased cost of an anti-corrosive propeller blade will be little in comparison with its greatly extended life.

The Shipbuilding Trade.—Mr. R. Knight, the general secretary of the United Society of Boilermakers and Iron Shipbuilders, in his report for the month of September, states:—"Since issuing our last report, we are pleased to say that trade still continues to improve in some districts, while in others they are not of such a cheerful nature, principally in the Mersey, London, and South Wales districts. This, no doubt, is owing to the coal crisis, which is causing a stagnation all over the kingdom; but it is to be hoped that the conflict will soon be over, for the sake of workmen who are suffering enforced idleness. We are able to record that during the present month 24 vessels, measuring 23,096 tons, were launched from the Clyde shipbuilding yards, as compared with 19 vessels, aggregating 20,484 tons, last August. The production for the past eight months reaches 182,356 tons, or 53,347 tons under the total for the corresponding period of last year. A gratifying amount of new work has been booked during the month, and fresh contracts representing 36,000 tons, as compared with only 8,000 tons secured last August. We learn from the Dewsbury district that some good foreign orders have been secured, but should the miners' dispute be prolonged, it is feared that the expectations of the members will be blighted in the coming winter. The returns from the branches show that there are 290 more members on the funds than last month, which shows that the percentage has increased to 17 this month against 16 last month. There is an increase of 29 members on the month."

The United States Cruiser "Minneapolis."—The triple-screw protected cruiser *Minneapolis* has been launched for the Government of the United States at Messrs. Cramp's yard, Philadelphia. Intended to serve as a "commerce destroyer," she is a steel, four-funnelled vessel, remarkable alike for size, for speed, and for armament. The chief dimensions and particulars of her are:—Length on load line, 412 ft.; moulded beam, 58 ft. 2 in.; mean normal draught, 23 ft.; displacement, 7,550 tons; I.H.P. 21,000; extreme speed, 22 knots; coal capacity with normal draught, 750 tons; maximum coal capacity, 2,000 tons; radius of action at 10 knots, 26,240 miles; guaranteed sea-speed, 21 knots. The magazines, engine-rooms, and vitals are protected by an overall steel deck, varying from 2½ in. to 4 in. thick. One screw is immediately before the rudder, on the centre line of the ship, and is a four-bladed screw of 10 deg. more pitch than the two others, which are placed one on each quarter, 15 ft. forward of the middle screw and 4 ft. 6 in. above it. These are triple-bladed. Each screw has independent triple-expansion vertical inverted engines. With the middle screw alone a speed of 15 knots can be attained; with the quarter screws alone a speed of nearly 19 knots. The cylinders are of 42 in., 59 in., and 92 in. diameter, for high, intermediate, and low pressure respectively, and 42 in. stroke. Steam is supplied by eight main-boilers, placed in four separate compartments, and carrying 160 lbs. per square inch as their working pressure. They are double-ended, 21 ft. 3 in. long, and 11 ft. 8 in. in diameter, with eight 42 in. corrugated furnace flues, and 1,128 steel 2¼ in. tubes. The total heating surface is 43,269 square feet, and the total grate surface 1,285 square feet. The estimated number of revolutions for extreme speed is 129 a minute. The armament, in addition to six torpedo-ejectors is to be composed of one 8-in. 15-ton 250-pr. R.B.L., two 6-in. 6-ton 100-pr. R.B.L., twelve 4-in. 1·5-ton 33-pr. Q.F., sixteen 2·24-in. 8-cwt. 6-pr. Q.F., eight 1·46-in. 73-lb. 1-pr. Q.F., and four Gatling machine guns. The 8-in. gun will be mounted as a chaser; the 6-in. guns will be mounted one on each bow; the 4-in. guns will constitute the broadside armament. The 8-in. and 6-in. guns have heavy steel shields attached to their mountings, and in wake of the remaining guns the ship's sides carry 4 in. and 2 in. nickel steel plates. The sub-divisions of the vessel, which is furnished with a ram, are so arranged as to form a complete double hull below the water line.

Steamship Lengthening.—The North German Lloyd mail steamer *Bayera*, which left Southampton on Sunday afternoon, September 17th, for China, has just undergone an alteration of a kind that will no doubt be of interest to shipbuilders and shipowners generally. This vessel having proved herself rather too small for the Eastern traffic, her owners decided to lengthen her by 50 ft., a work requiring six months to complete, and this has been successfully accomplished at the shipbuilding yard of Messrs. Blohm & Voss, at Hamburg. Being placed in dry dock, the steamer was severed amidships forward of the engine-room, and the forepart drawn forward the required distance by hydraulic appliances. A whole compartment, 50 ft. in length, was then built on between the two portions, and the necessary strengthening affected throughout. The *Bayera* is now 450 ft. in length, and her carrying capacity for cargo has been increased by 2,400 cubic metres. The extra length has also added largely to the passenger accommodation. The first saloon, which has been entirely removed by the firm of F. C. Pfoff, of Berlin, is now placed on the upper deck, amidships, forward of the engines, and extends the whole width of the ship. All the public rooms have greatly gained in extent, and are placed in more advantageous positions. Some of the first-class cabins are on the upper and some on the promenade decks. The latter has now a length of 200 ft., and is covered by a permanent awning. The dining saloon and the smoking-room for the second-class passengers are also on the upper deck, but placed aft, and the sleeping cabins formerly used by the first-class passengers are now made available for those in the second saloon, while various other improvements were also made possible by the alterations. It is stated that the *Bayera* is the first large ocean steamer in which such an important and extensive addition has been made. The *Bayera* on her recent trial trip attained a speed of about 15 knots.

The Union Co.'s Fleet.—This company's new twin-screw steamer *Greek*, which left Southampton on Saturday, September 23rd, on her first voyage to South Africa, *via* Lisbon and Teneriffe, has been inspected by a number of visitors interested in commercial and shipping affairs. She was built by Messrs. Harland & Wolff, of Belfast, for the inter-colonial service of the Union Co., but, although specially adapted for cargo, she has ample and excellent accommodation for passengers. The gross tonnage of the *Greek* is 4,740, and her leading dimensions are as follows:—Length, 400 ft.; breadth, 47 ft.; and depth, 31 ft. She is propelled by two sets of triple-expansion engines, with cylinders of 18½ in., 30 in., and 50 in. in each set, and a stroke of 42 in. The engines develop an indicated power of 2,270 horses. She is fitted with manganese bronze screws. The ship is provided with every convenience of the most modern character, including electric light, refrigerator, and cold chambers for the conveyance of provisions and fruit. With large carrying capacity for cargo the *Greek* has a light draught of water, to enable her to cross the bars at East London and Natal, and land passengers and goods direct on to the wharves at those ports. The *Greek*, which is commanded by Captain G. M. Moloney, is a sister ship to the *Gaul* and the *Goth*, both of which have completed a successful voyage to the Cape and back, and the former has sailed on her second trip. These vessels carry sufficient coal to take them from Southampton to the Cape of Good Hope and Natal and back, whereby the discomfort to passengers of coaling at ports of call is avoided.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from August 18th, to September 13th, 1893.

15639 J. F. Baker. Apparatus for indicating on board ship the approach to shallows or rocks.
15651 J. M. Porter, and W. A. M. Brown. Steering apparatus for steamers.
15655 G. Dunnet. Improved marine engines.
15663 F. C. Lynde. Frames of manholes.
15670 A. T. Booth. Valve gear for steam engines.
15690 D. Tweddle. Electric marine governors.
15717 J. B. Alliott and J. M. C. Paton. Furnaces.
15733 D. Johnston and R. Shaw. Heating feed water.
15741 H. B. and J. S. Watson. Water gauge fittings.
15755 W. McKeegan. Refrigerating machinery.
15765 J. M. Drorier, and J. Carnaire. Generators.
15776 J. L. Huber. Indicating position of rudders.
15806 J. Matheisen. Alarm for water heaters
15808 J. Mc. L. McMurtrie and T. Hinshelwood. Lubricators.
15815 D. R. Berry. Valves.
15818 J. Sloman. Safety boat sail sheet clip.
15839 W. Chadwick. Ships' towing lines or ropes.
15846 A. W. Carry. Valve.
15847 E. Lloyd. Balanced slide valves.
15851 A. Henderson, J. E. Welsh, and J. Horn. Calculating the H.P. of engines.
15862 W. H. Wilson. Water tube marine boilers.
15863 W. H. Wilson. Return tube marine boilers.
15880 C. W. Fielding. Parts of boilers.
15882 A. Boudeville. Utilisation of the motion of water waves.
15883 C. H. Martini. Construction of boats, &c.
15886 C. A. McEvoy. Sounding apparatus.
15887 W. Hutchings, and W. F. Beattie. Flotative arrangement.
15889 F. W. P. Parker. Water gauges and gauge cocks.
15894 C. W. Reneau, and J. A. Lewis. Furnace doors.
15902 G. C. Dymond. (W. H. Laird, U.S.A.). Furnaces.
15903 C. D. Doxford. Lowering and housing boats.
15911 C. Jones, jun. Motors.
15943 A. A. Clarke. Propulsion of ships by waves.
15944 B. E. Archer. Method of sounding whistles.
15982 F. T. Rodwell and G. Deer. Steam boilers.
16041 F. Bosshardt. (J. R. Frikart, Germany). Steam engines.
16045 A. Bagshawe. Detachable link chains.
16052 W. Richardson. Pumps.
16064 L. Epstein. Torpedoes.
16078 R. Skene. Gas and oil vapour engines.
16079 H. Tipping. Rotary pumps and blowers.
16082 J. Milton. Smoke consumers for furnaces.
16085 A. Haworth. Rowing boats and in boat oars.
16087 W. Beattie. Pipe joints.
16093 W. Maycock. Water heating apparatus.

16101 S. M. Cockburn. Suction dredgers.
16120 H. Oldroyd. Joints for pipes and tubes.
16131 A. J. Boult. (H. Snowman, U.S.A.). Augmenting power of engines.
16134 T. E. Isherwood, A. Rutherford, and D. Holmes. Governors.
16140 J. A. and H. A. Lamplugh. Speed indicator.
16160 J. Pascoe. Propelling ships.
16174 C. W. Carter. Metallic packing for piston-rods.
16189 J. Verity. Couplings for propeller shafts.
16206 D. W. Shaw. Rowing and sailing boats.
16257 J. C. Webb. Self-acting rapid water boiler.
16262 E. Duncan, G. H. Bennett, and H. W. Bryant. Valves.
16277 H. A. Pertwee. Steam valves.
16289 W. Sales. Propulsion of boats and launches.
16312 G. C. Parini, and P. Duff. Screw propellers.
16337 J. Shenton. Combustion Furnaces.
16340 W. L. Winans. Spindle-shaped ocean steamers.
16352 F. Buckland. Preventer of incrustation.
16382 G. M. Marchant. Forcing lubricant into cylinders.
16383 B. S. Roberts. Gearing.
16390 W. B. Teale & J. Clement. Lubricators.
16401 J. Owens. Convertible boats and traction engines.
16402 T. Head. Watertight bulkhead doors.
16421 H. Schneider. Manufacture of armour-plates.
16426 W. H. Eastwood. Metallic packing for engines.
16429 J., H., & W. Chidgey. Water motors.
16441 P. G. E. Daniel. Supporting boats above water.
16442 R. Wood (W. F. C. Fail, New Zealand). Sight-feed lubricators.
16443 I. A. Timmis. Communication on board ship.
16479 T. W. & C. Bridges & J. Davies. Corrugating metal sheets.
16480 K. D. Bowen. Electrically-propelled boats.
16481 J. O'Clark. Boiler tubes, &c.
16485 L. Kaufmann. Single-acting steam engines.
16497 J. Southall. Oil motor engines.
16499 F. A. Langen. Nautical compasses.
16505 C. W. Holmes. Spanners and wrenches, &c.
16513 W. Payton. Drilling machines.
16520 G. Hutson & G. Hutson, Junr. Boilers.
16542 W. Fairweather (The Babcock & Wilcox Co., United States). Tubes.
16543 W. Fairweather (The Babcock & Wilcox Co., United States). End pieces for tubes.
16545 W. Fairweather (The Babcock & Wilcox Co., United States). Dishing plates of boilers.
16578 A. Jeffrey. Gearing chains.
16593 A. R. Bennett. Steam boilers.
16596 J. Partington. Steam boilers.
16625 J. Schmidlin. Propelling devices for ships.
16731 B. Boyes. Appliances for steam boilers.
16733 W. B. Thompson. Mechanical propulsion of ships.
16751 O. Brünler. Gas or petroleum engines.
16757 E. Wall. Protecting ships against torpedoes.
16762 E. E. Wigzell. Mariners' compasses.
16770 G. M. Hamlyn. Electrical connections to floating vessels.
16773 T. B. Heathorn. Apparatus for propelling boats, &c.
16794 A. Paterson. Sight-feed lubricators.
16798 D. McGregor, Jun. Mariners' compass.
16800 T. W. Elliott. Iron coating composition.
16805 R. C. Young. Ship steering apparatus.
16807 G. Pinnington. Ships.
16810 J. H. Clasper. Swivel rowlocks for boats.
16811 W. Cadman. Reversing gear of pumps.
16833 W. Smith. Pressure gauges.
16834 W. Smith. Water gauges for steam boilers.
16847 E. W. Cooper. Lubricators.
16852 G. Milne. Feed-water purifying apparatus.
16861 P. E. Hodgkin. Operating pistons of pumps.
16862 H. A. House, Sen., H. A. House, Junr., & R. R. Symon. Valve gear.
16869 J. Gamgee. Vapour condensers or devaporators.
16900 F. W. Crossley & J. Atkinson. Internal combustion engines.
16927 C. H. Dibb. Method of generating steam.
16934 J. Bryant. High-pressure boiler.
[illegible]61 W. Brook & J. Weir. Marine steam engines.
[illegible]78 J. J. Meldrum & T. F. Meldrum. Furnaces.
[illegible] W. J. W. & P. C. Wheeler. Air propellers.
16997 H. Heenan. Raising sunken vessels.
17010 H. A. House, H. A. House, Jun. & R. R. Symon. Anchors.
17011 H. A. House, H. A. House, Jun. & R. R. Symon. Apparatus for lubricating.
17014 H. H. Lake (Die Firma Fried. Krupp, Germany). Pipes.
17033 D. France. Grates of steam generators.
17079 E. Brown. Compasses.
17086 J. Hall. Steam generator with injector.
17089 W. T. Eades. Pulley blocks, &c.
17101 R. D. Smillie & W. C. Wallace. Tubes.
17123 B. W. Maughan. Propeller.
17134 C. Casman. Propelling apparatus of ships.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1C, denotes First Class; 2C, Second Class.

August 26th, 1893.

Anderson, Jas. ..	1C	London
Bjorkman, A. ..	2C	N.Shields
Cameron, W. H.	2C	Sunderl'd
Cameron, W. H.	2C	London
Camilleri, A. ..	1C	„
Dixon, H. G. ..	1C	Bristol
Duncan, James	2C	N.Shields
Evans, Evan....	2C	London
Foster, Thomas	2C	N.Shields
Harper, John ..	2C	London
Harvey, Fredk.	2C	„
Hunter, John ..	1C	Sunderl'd
Lewin, Wm. J.	2C	Liverpool
McPherson, J. ..	2C	N.Shields
Miller, Thomas	1C	„
Palmer, James J.	2C	„
Pow, William S.	1C	„
Purton, Ernest	2C	Bristol
Reston, Wm. C.	1C	N.Shields
Salkeld, E. R. ..	2C	„
Swanson, D. G.	2C	London
Trant, Arthur S.	2C	Liverpool
Wadbrook, F.W.	2C	S'ampton

September 2nd, 1893.

Barry, H. O.....	2C	N.Shields
Dangelman, W. A.	2C	London
Downie, Wm. ..	1C	Glasgow
Emery, Henry R.	1C	Liverpool
Farne, Wm. Hy.	2C	N.Shields
Filshie, George	1C	Liverpool
Finlayson, Peter	2C	London
Frank, Jno. C. ..	1C	Cardiff
Gourlay, Jas. ..	1C	Glasgow
Harper, Geo. E.	2C	N.Shields
Hay, Jno.	1C	Glasgow
Hickman, W. R.	2C	Cardiff
Hill, Frank H...	1C	Liverpool
Hodgson, Edw.	1C	N.Shields
Jackson, Jno. C.	2C	„
Little, Jno. Thos.	2C	„
Logan, Alex.....	2C	Liverpool
Lounsboro, W.H.	1C	„
Morris, Robt. ..	2C	N.Shields
Peel, Jno. B. ..	2C	„
Robertson, Thos.	2C	Glasgow
Schmidt, C.T. ..	2C	„
Scott, Joseph ..	1C	N.Shields
Shapter, Thos.	1C	London
Sibbard, T. K. ..	2C	Glasgow
Smith, H. H. N.	2C	N.Shields
Spence, Stuart ..	2C	Liverpool
Wheatley, A. ..	1C	N.Shields
Wright, Jas. ..	2C	London

September 9th, 1893.

Abel, Evan T...	1C	Liverpool
Avery, Daniel P.	1C	„
Campbell, Thos.	2C	N.Shields
Clark, Robert..	2C	Leith
Dickson, A. ..	2C	N.Shields
Florence, G. L.	1C	London
Fuller, P. S. ..	1C	N.Shields
Haigh, Edwin	2C	Liverpool
Honeyman, Geo.	2C	N.Shields
Lee, Robert F.	1C	London
Linklater, Alex.	2C	„
Lowe, W. A. ..	1C	N.Shields
Macnab, Geo...	1C	Leith
McInnes, Dnld.	2C	N.Shields
Modkin, G. G.	2C	London
Nicholson, J. T.	1C	N.Shields
Nicol, John W.	2C	London
Robinson, Wm.	1C	N.Shields
Taylor, John T.	2C	„
Tyson, Thomas	2C	Liverpool
Verrall, R. P...	1C	London
Watson, David	2C	N.Shields
Young, A. ..	2C	„

September 16th, 1893.

Allen, H. C. ..	2C	W.Hart'l
Anderson, H.J.J.	2C	Liverpool
Avery, George	1C	N.Shields
Carruthers, J.D.	2C	„
Darnell, George	2C	„
Douglas, James	1C	„
Eaton, Alfred..	2C	Liverpool
Findlay, A. ..	1C	Dublin
Gillespie, R. W.	1C	Greenock
Gordon, Charles	2C	London
Henderson, J...	2C	N.Shields
Irvine, J. ..	1C	Greenock
Keightley, M.W.	2C	W. Hart'l
Lambert, R. ..	1C	N.Shields
Lennie, J. S. ..	1C	Greenock
Lindsay, J. ..	2C	London
Martin, William	2C	„
Mathison, W...	2C	N.Shields
Meiklejohn, R.W.	2C	London
Minto, G. ..	1C	N.Shields
M'Kellar, J. ..	2C	Greenock
Montgomery, S.	2C	Liverpool
M'Quitty, J. ..	1C	Dublin
M'Rae, Thomas	1C	Greenock
Poole, Wm. J.	2C	W. Hart'l
Porteous, G. E.	1C	N.Shields
Price, Thomas	2C	Liverpool
Read, W. ..	2C	Plymouth
Reid, P. ..	2C	Dublin
Roper, R. ..	1C	W. Hart'l
Smyth, R. ..	1C	London
Stewart, R. H.	2C	Dublin
Sullivan, John.	2C	Liverpool
Teare, George	1C	„
Thompson, P.G.	1C	London
Trechmann, J. E.	1C	W. Hart'l
Turnbull, Alex.	1C	Liverpool
Walker, James	1C	Greenock
Walker, J. ..	2C	N.Shields
Watson, H. ..	2C	Plymouth
Williamson, J.	1C	Greenock
Wilson, D. ..	1C	„
Wright, J. ..	1C	N.Shields

The Marine Engineer.

LONDON, NOVEMBER 1, 1893.

THE Liverpool *Journal of Commerce* made a statement at the time of the *Lucania's* first eastward voyage to the effect that not only was the European mail given by the United States Post Office to other and much slower vessels, but that further large blocks of mail matter, specially addressed "per *Lucania*" was actually sent by the department by the *Kaiser Wilhelm II.* This correspondence accordingly arrived some three day later than it should have done, and not only were the correspondents thereby inconvenienced, but the late delivery of correspondence so marked brought undeserved discredit on the Queenstown route. We are not in a position to discuss the accuracy of the *Journal of Commerce's* statement as to the sending of blocks of specially addressed correspondence marked "per *Lucania*" by another ship. The statement that the *Lucania* did not get the mail is admitted and justified on the most extraordinary rule of red tape that ever came from the stupidity of a department. No mail is given by the United States Post Office to a liner until she has shown her paces on an eastward trip. The fact that the *Lucania* did the fastest maiden passage by some three-quarters of a day stood her in no stead. The odds were heavy that she would break the eastward record, but the mails must go by vessels which had by experience shown their inferiority to her. But the incident is not ended here. The statement provoked the wrath of the department, and a Mr. Pigott, a high official in the bureau, penned a letter to the editor which—of course quite unintentionally—is the greatest justification of the policy of the British Post Office that has yet come under our notice. He says, "I am in a position to know that there is no unjust discrimination by the New York Post Office authorities against any European mail steamer of whatever nationality leaving this port. The mails are apportioned only according to the respective merits of the vessels delivering the mails in the shortest possible time . . . . There has just been the slightest favour shown to our steamers, the *New York* and the *Paris* of the American line, by giving them the full European mail over the White Star Line boats, but the supposition is that they deliver the bulk of the mail more quickly *via* Southampton than the other boats would *via* Queenstown and Liverpool." Now this is in the first place a magnificent assumption. No one, not even the Southampton Press, ever dared to argue such a thing, let alone to assume it. The argument has been that the saving of time by sending the mails *via* Queenstown did not save sufficient time to justify the cost of the special service. The special service is now only given when a full mail goes *via* Queenstown, and so now the White Star Liners do not get the special service when they sail against the fast American boats which are favoured with the mails. If they had done so they would have demonstrated the incorrectness of Mr. Pigott's assumption to no small extent. But leaving this point, his admission of favouritism to the vessels under their own flag (after denying all favouritism) is splendid. Had he boldly said, "We do favour our own ships. We want to encourage the American mail service," we should have said, "All honour to you—that is the spirit we admire." But this he does not do. Whilst professing to be without fear and without favour, Queenstown and the British lines are by his own admission covertly pushed on one side and discredited, and he proves the necessity for our own authorities to stand by their own people.

THE subject of the better education for apprentices and officers of the Mercantile Marine has been enthusiastically and minutely dealt with by Mr. William Allingham, in a paper read before the Shipmasters' Society of London. Mr. Allingham points out that all the world is progressing in technical and scientific knowledge, and that as it has been proved that such knowledge is of great commercial value in industrial pursuits and technical professions, the future shipmaster of this country whose life and welfare depends upon her supremacy in the carrying trade at sea should not be behindhand in qualifying themselves to keep pace with the times. It is a curious and noteworthy fact that though public money is largely spent through the County Councils, the Science and Art Department, and the Board of Agriculture, for the furtherance of technical education, and there is no lack of private munificence from individuals and City companies for the encouragement and support of youngsters endeavouring to excel in the scientific knowledge of their trade or profession, the education of mercantile marine apprentices is left to the now obsolete method of practical apprenticeships. It is well known that the mere education in mechanical engineering afforded by the routine of shop work without simultaneous education of the intelligence in the scientific laws underlying such operations, has broken down, and is now discarded, as a sufficient education for an engineer who desires to become more than an artizan, and yet it does not appear that any wealthy individual or corporate bodies have ever arrived at the same conclusion with regard to the training of embryo shipmasters in their apprenticeship. In Mr. Allingham's opinion the examinations under the

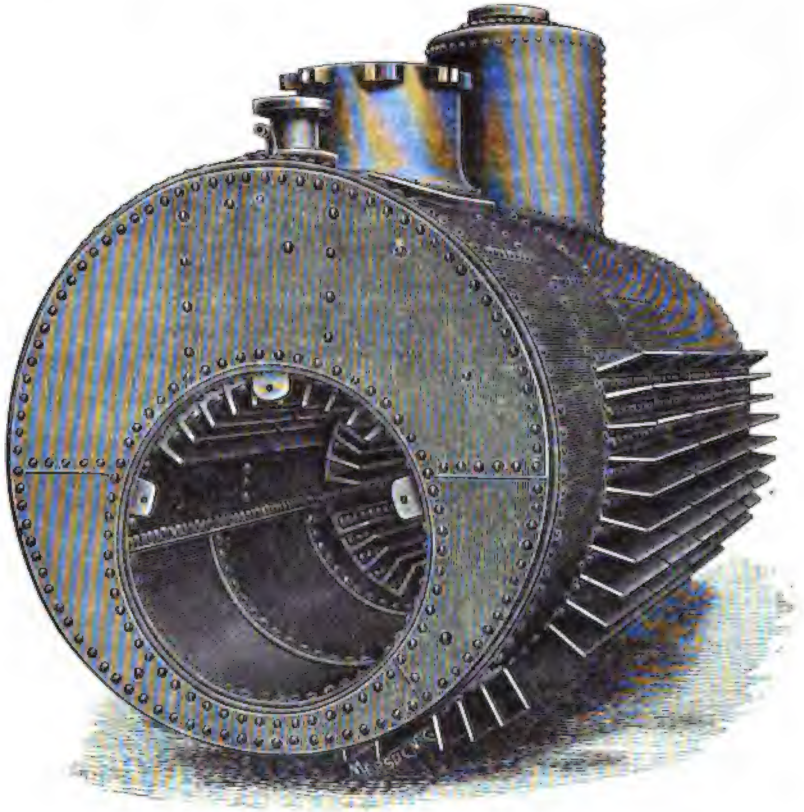
Board of Trade for mate or masters' certificates are no test, either of the efficiency of the candidates in a true scientific knowledge of the mathematical part of their duties, or of an efficient practical acquaintanceship with their practical duties, and that the passing of such examinations depends merely upon the skill of the crammer, and a surface knowledge of the candidate, forgotten, as soon as finished with. It is proposed that this should be remedied by actual sea-going training ships in which both a practical and theoretical training should be given to sea-going students to qualify them eventually as shipmasters. Mr. Allingham instances that this has already been done in the United States, where New York has the corvette *Saratoga*, and Philadelphia, a similar vessel, the *St. Mary*, placed at their disposal with a complement of officers for the training of youths as officers in the Mercantile Marine. San Francisco, California, has also requisitioned the Government for a similar vessel, and further, has voted a good round sum for its maintenance. Here is an example for the County Councils of our seaport towns to follow, or for the shipowners to emulate. It is a curious thing that so soon as a boy goes to sea as an apprentice all interest in his further education seems to vanish. He picks up his manual education by the most elementary and trivial employment, and is then thought good enough for one of the most noble and scientific professions, that of seamanship and navigation. Mr. Allingham proposes that, as the Science and Art Department spends a royal income in payment of teachers on land in science classes by results, why should not similar payments on results be made to shipmasters, or others of their officers, who would take the trouble to train the youngters in the science and practice of their profession afloat. It is not a bad idea, and would convert every ship, as far as regards its youngsters, into a registered science class for seamanship and navigation, and at the same time give an inducement for the master or officer to give attention to the education of their apprentices.

Lord Armstrong, in his address to the company of which he is the valued chairman, has expressed some important views upon the course of future naval construction. In referring to the serious national loss lately sustained by the sinking of the *Victoria*, he considers that there are two useful lessons to be learnt from the disaster. First, the danger of "putting too many eggs in one basket," since large vessels are no more exempt from accidental loss than war vessels of the smallest size, while the danger of collision in handling them is much greater. Their turning circles are far wider, and when once put into motion momentum is difficult to control. The loss of such a ship and the sacrifice of so many valuable lives are not only deplorable as a waste of life and treasure, but amount to a serious diminution of England's naval power, and call for very grave reflection as to the policy of devoting so large a proportion of naval expenditure to the construction of these mighty vessels called battleships. Again, the serious damage to the bow of the *Camperdown* shows that although striking with a very restricted momentum, the results imperilled the buoyancy of the striking vessel. What would have been the effect upon the *Camperdown* had she rammed with the vigour and heat of combat is not difficult to prognosticate. Both vessels would have gone down in a few minutes. At the same time the effective character of the ram as an offensive weapon is fully demonstrated, and evidently no armour plating can withstand its shock. The lesson therefore would appear to be that for the effective ramming of a large battleship even when heavily armoured, the shock of a much lighter ramming vessel, if the blow is delivered at a good speed would suffice to send the rammed battleship to the bottom. The destructive effect upon the ram of the *Camperdown* is in our opinion due to the enormous inertia of the ramming vessel and the slow speed of collision. It is well known as an axiom in dynamics that the splitting and destructive effect of a blow upon a stricken body increases as the square of the speed with which a body strikes it, and the destructive effect upon the striking body is reduced by the very speed that has been given to its impact. It is a well-known experiment that a tallow candle may be made to pierce a wooden board, that a sand blast will destroy and remove glass or metal, and as a deduction we arrive at the curious result that even a lightly-built cruiser, if sufficiently rigid in the construction of its bow or ram, could ram and destroy a heavily armoured battleship, even with less self-destructive effect upon the ramming ship than in the case of the *Camperdown*, provided the blow were given with sufficient velocity. Thus for ramming purposes it would appear that small vessels of rigid build and of high speed would be equally as destructive and suffer less self-injury in their work than the present larger battleships if so employed. Lord Armstrong emphatically iterates his opinion that England requires a great increase of swift cruisers, and instances several cruisers which the firm has recently built for Foreign Governments and which seem to be some of the fastest warships afloat and heavily armed. These ships are the *Ninth of July*, built for the Argentine Government, which is of 3,600 tons displacement, and achieved at her official trials 22·7 knots. Even this performance has been exceeded by the *Yoshino*,

large cruiser of 4,200 tons displacement, built for the Japanese Government, which actually reached a speed of 23·1 knots or 26½ miles per hour. Both of these vessels carry an exceptionally heavy armament and are the fastest warships afloat. It is a pity to see these fine vessels added to any navy but our own. Upon new explosives, Lord Armstrong considers the British explosive "cordite" to be the most satisfactory of all others in the market, and considers that the use of such an explosive in shells will enable quick-firing guns to quickly destroy and blow to pieces the unarmoured ends of ironclads. Armour, however, of small thickness causes such shells to explode harmlessly outside the hull; but it is a most perplexing problem how to sufficiently protect a warship from stem to stern with defensive armour, without thereby so increasing the weight of a vessel as to reduce its possible and desirable weight of armament, or to make it of unwieldy size and displacement, which is contrary to the deductions of best policy as outlined above. Lord Armstrong does not think that possible risk in using the modern high explosive will deter an enemy in warfare from making use of them, and further, he considers that care and further knowledge of the material under all conditions will gradually eliminate any special risk attached to it. He would like to see a great multiplication of swift vessels of moderate size, and considers that the old-fashioned fighting at close quarters is obsolete as leading to mutual destruction, but considers the superior seamanship and pluck of the British Navy would give them a still more marked supremacy under such altered conditions of warfare.

IMPORTANT IMPROVEMENT IN BOILER CONSTRUCTION.

THE accompanying illustrations shows a novel improvement in boiler construction, introduced by the "Advance" Boiler Co., Limited, of St. Mary's Gate, Manchester, for promoting and increasing evaporation. The improvement, which is applicable to land or marine boilers, secures a greatly increased evaporative efficiency without introducing any complicated parts. The system consists of a simple arrangement of angle irons, riveted longitudinally on to the inside of the furnace flue and on the outside of the boiler shell in the side flues, the function of these angle irons being to arrest and absorb the heat and transmit it to the water. A test boiler, of the Cornish type, 15 ft. long by 5 ft. diameter, has been constructed on the above system. On this boiler there are ten 3 in. by ⅜ in. angle irons riveted on to the first and second plates in the tube over the fire-grate. Beyond the bridge, the angle irons are 3 in. by 5 in. by ⅜in., and are riveted around the flue, the 5 in. part of the angle iron being presented to the flames, and forming the rib, or heat-absorber. On the outside of the shell



the angles are 3 in. by 6 in. by ⅜ in., with the 6 in. part radiating from the shell into the side and bottom flues. Beyond these additions the boiler has in no way been altered from the plain Cornish construction. With this boiler a series of tests were made of five hours duration. During the test the average draught was 237·33 ft., and the average temperature of the feed water was 57·25 deg. Fahr., and that of the gases, 772·50 deg. Fahr., the average temperature of the atmosphere being 64 deg. Fahr. The coal consumed was 5 cwt., less 40 lbs. of ashes, or 520 lbs. of fuel, and the water evaporated was 4,730 lbs. With the boiler in its normal condition as a simple Cornish boiler, and before any angle irons were affixed, the evaporation was 4·67 lbs. of water per lb. of coal. The results of the test made showed an improvement of nearly 100 per cent. in the evaporative power of the boiler upon its former self. Besides the advantages secured as shown by the tests, other collateral advantages claimed for this system are that not only do the angle irons arrest the heat and transmit it to the water, but they form channels along which the flames sweep in close contact with the boiler, in this respect also increasing its efficiency, whilst the boiler is materially strengthened by the addition of the angle irons, which form a series of longitudinal ribs external to the flue and shell. Reports have been obtained from several leading engineers who are authorities on boiler construction, and all of these are of a most satisfactory character, as to the very greatly increased efficiency obtained by the very simple arrangement of angle irons riveted longitudinally on the inside of the furnace flue and on the outside of the boiler shell. Amongst the advantages claimed by the company for this new system of boiler construction, is that the arrangement of angle irons has the effect of arresting and conducting to the water a large percentage of the waste heat, thus ensuring great economy in fuel, whilst improved draught, reduced fire-grate area, with increased combustion per foot of grate area, and increased durability of the boiler, are also secured. It is also claimed that the boiler is practically smokeless, and that there is less incrustation by reason of the increased circulation of the water.

FIRST-CLASS BATTLESHIP "ROYAL OAK."

MESSRS. LAIRD BROS., of Birkenhead, having completed the large line of battleship, the *Royal Oak*, the vessel was last week thrown open for inspection by press representatives and a number of invited friends of the firm prior to the ship leaving the Mersey for the Government Yard at Portsmouth. The *Royal Oak* is one of the largest battleships constructed for the British Navy, and was built under the Naval Defence Act.

Her dimensions are:—Length, 380 ft.; breadth, 75 ft.; mean draught, 27 ft. 6 in.; displacement, 14,150 tons; freeboard, forward, 19 ft. 6 in.; aft, 18 ft.; I.H.P., natural draught, 9,000; forced draught, 11,000; speed, natural, 16 knots; forced, 17½ knots; coals carried at the designed load draught, 900 tons; coal endurance at 10 knots, 5,000 knots; total weight of armament, 1,910 tons; height of heavy guns above water-line, 23 ft.; length of the belt or side armour, 250 ft.; greatest thickness, 18 in.; protective deck, 3 in.; total weight of armour, backing, and including protecting deck, about 4,500 tons.

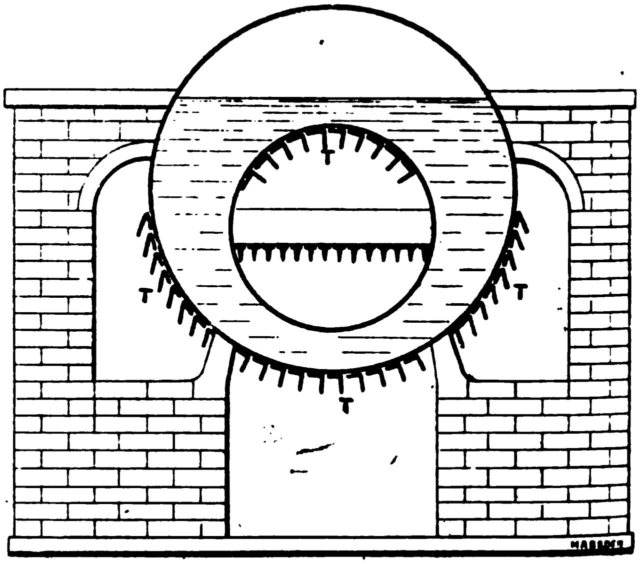
As befits her enormous bulk and weight, the construction of the ship has been made exceptionally strong. The hull alone absorbs over 9,500 tons of the total displacement.

She is built entirely of mild steel, the stem and stern posts and shaft brackets being formed of steel castings.

The hull from end to end is largely subdivided, for the purpose of minimizing to the fullest possible extent the danger arising from damage to the bottom plating from rocks or torpedoes, and that this form of construction is effectual was exemplified when H.M.S. *Howe* went ashore at Ferrol.

The framework has been specially designed with reference to the great weight to be carried, and additional stiffness is secured by double longitudinal bulkheads, which form a passage for easy communication below the water-line from end to end, and within these are placed the auxiliary magazines.

A protective steel deck 2½ in. in thickness, extends under water from the bow for about 76 ft., and from the stern for a distance of about 72 ft. From this deck, and resting upon an armour shelf, is built a belt of steel-faced armour with a backing of teak. The lower edge of the belt extends 5 ft. 6 in. below the load draft line, while the upper edge is carried 3 ft. above the line. The greatest thickness is 18 in.; the belt itself extending over a length of 250 ft., out of a total length of 380 ft., and terminating in armoured bulkheads. At the fore and after ends of the belt, and rising directly from the protec-



tive deck, are the barbettes strongly framed in mild steel, protected by teak backing and armour 17 in. thick.

Superimposed upon the thick belt is placed another belt of light armour, 4 in. thick at the sides and 3 in. thick on the screens running across the ship, and behind this side armour, coal bunkers are arranged whereby additional protection is secured. At level of upper edge of the armour belt there is also a 3 in. steel deck, worked so that horizontal deck protection extends from end to end.

The guns are protected by 6 in. screens, and the gun crews by armoured empalements, and in order to procure a safe passage for the ammunition from the several magazines to the guns of the secondary armament, armoured tubes have been specially fitted. It is also to be noted that, with a view of preventing water from finding its way below the protective deck, means are provided for closing the several openings by water-tight covers, while in the case of those which must necessarily remain open, coffer-dams have been fitted with the same object.

She is lighted throughout with an installation of over 620 electric lights, and also equipped with four search lights of 25,000 candle-power, each of which will be worked by dynamos under protection. The ship in action will be fought from either of two conning towers, of which the forward one is armoured to the extent of 14 in., and the after one to 3 in.

The port and tarboard engine and boiler rooms are separated by middle line longitudinal bulkheads extending the whole

length, and there are also longitudinal bulkheads at the sides extending throughout the machinery space, forming coal bunkers and wing spaces.

On the platform, debris, and lower deck is placed the auxiliary machinery for the working of the ship, including steering engines, electric engines, and hydraulic pumping engines, as well as a fully equipped workshop and numerous store rooms.

The officers and crew are accommodated on the main and belt decks. The officers' accommodation consists of very completely fitted cabins situated aft, the superior officers being located on the main deck. The admiral's suite of rooms, which are especially handsomely fitted, are at the extreme aft end of the main deck, and communicates with a handsome stern walk.

The upper deck extends from stem to stern without a break, and above it is a continuous bridge deck, extending the whole length between the barbettes, and on this deck are the conning towers surmounted by the navigating bridge and chart-house.

The boats, of which there are 21, including two torpedo boats, are stowed amidships.

A strong steel derrick is fitted to the mainmast for lifting them, and the foremast is also fitted with a derrick for working those of a lighter description.

The masts, which are built of steel, are fitted with military and signalling tops, and there are two funnels on the same athwartship lines.

The armament of the *Royal Oak* will comprise four 13·5 in. 67-ton guns, mounted in barbette in pairs, and firing a projectile weighing 1,250 lbs., with a powder charge of 630 lbs.; ten 6-in. 100-pounder quick-firing guns, the four on the main deck being mounted in casemates protected by 6-in. armour, while the six on the upper deck are mounted on sponsons; sixteen 6-pounder and nine 3-pounder quick-firers: eight small machine guns, and two 9-pounder field guns. The auxiliary armament is distributed all over the ship, and extends from bow to stern, the top sides and bridges having a considerable number disposed upon them. The main armament is worked by hydraulic machinery, supplied by Sir W. Armstrong, Mitchell & Co. The other guns are all worked by hand, the 6-in. by one man, others being employed for feeding purposes.

The ship is also fitted with seven torpedo tubes, of which two are submerged. The number of torpedoes carried is 18.

The main propelling machinery consists of two sets of engines of the triple-expansion inverted type. Each set is placed in a separate engine room. The cylinders are 40 in., 59 in., and 88 in. in diameter respectively, with a stroke of 51 in.; they are entirely independent castings, and are bolted together by brackets. The receivers consist of copper pipes attached to gun-metal branches, and expansion joint stuffing-boxes. The whole of the cylinders are steam-jacketed, the working barrels of the high pressure being of forged steel, and those of the low and intermediate pressure cylinders of cast-iron. The slide valves for the high and intermediate pressure being of the piston type, whereas the low pressure cylinders have flat double-ported valves. A special type of relief ring is fitted at the back of these flat valves. Balance cylinders are fitted to the high pressure and intermediate valves and assistant cylinders to the low to reduce the strain on the valve-gear as far as possible. The valve gear is of the double eccentric link motion type, and is moved by means of a double cylinder starting engine. The columns are of wrought steel. The main condensers, which are of brass, have a collective cooling surface of 14,500 square feet.

The steam is condensed outside the tubes, the circulating water passing through them. The water is supplied by four 18 in. Allen's centrifugal pumps, each driven by an independent engine. Suctions are also led to the bilges from these pumps, which give a total bilge pump power of 4,400 tons per hour. The crankshaft for each set of engines is in three separate pieces, the cranks being set at 120 deg. to one another. The crank, thrust and propeller shafts are all hollow, an 8 in. hole being bored through their entire length, and they are each forged from a solid steel ingot. The thrust blocks and collars are of cast steel. The latter are lined with white metal, and are of the ordinary type. The screw propellers are four-bladed, the blades and bosses being of gun-metal.

Steam is supplied by eight single-ended cylindrical return tube boilers, working at 155 lbs. pressure per square inch, and being 15 ft. 4 in. in diameter, and 9 ft. 4 in. long, each boiler aving our corrugated furnaces 3 ft. 4 in. in diameter. The total grate surface is 710 square feet, and the total heating surface, 20,174 square feet. For the purpose of shutting off each combustion chamber from the others, and also for regulating the draught in same, separate dampers are fitted in the passage from each through the smoke-boxes, and gear arranged to work the same conveniently from the stokehold floor. Following out the principle of subdivision, each two boilers are in a separate watertight compartment with independent coal supply, separate access to and from main-deck, &c. The exhaust steam from the whole of the auxiliary machinery in the ship is led into an auxiliary exhaust pipe, which is connected both with the atmosphere by means of the auxiliary waste steam pipes carried up outside the funnels, and with the two auxiliary condensers, one in either engine-room. Each of the latter condensers has its own air and circulating pump, entirely independent of those for the main condensers; and worked by independent engines. The combined cooling surface of these two auxiliary condensers is 1,800 square feet. In the main engine-rooms there are also two double-cylinder turning engines, two evaporators with independent feed-pumps, two distillers with circulating and distributing pumps, four No. 2 Admiralty type main feed pumps, of ample size to supply the whole of the boilers at full power, four double-cylinder double-acting bilge and fire pumps of No. 1 Admiralty type. A pump for pumping out the drain tank, and two ventilating fans 6 ft. in diameter, each driven by a separate steam-engine. In the boiler compartments there are eight fans 5 ft. 6 in. in diameter, each with its separate engine for supplying the forced draught for the boilers, and also four double-cylinder double-acting auxiliary feed pumps of No. 2 Admiralty type.

The weight of the anchors and chain cables is 130 tons, and if the cables were laid out in a single line it would extend about one mile.

The total weight of the metal work treated in the construction is upwards of 9,000 tons, and the wage expenditure in Birkenhead represents considerably over £220,000, which is, of course, exclusive of labour in manufacture of armour-plates, forgings, and a variety of fittings from sub-contractors.

LONGRIDGE'S OUTSIDE DROP KEEL.

THE recent success of the *Vigilant* in the American Cup races has again demonstrated the advantages of an adjustable centre keel over the fixed keel adopted by the designer of the *Valkyrie* and *Britannia*.

The designs of movable centre boards, hitherto in use, have laboured under certain prominent disadvantages which hinder their universal adoption; notably the weakened form of construction necessitated by provision of space for the reception of the centre board within the boat, and the great disturbance of meta-centric height and trim, when the keel is fully raised.

The accompanying illustration shows a design in which these objections are almost entirely removed.

The keel consists essentially of a pair of plates or fins, hinged at their lower ends to a lead bulb of suitable weight, their upper ends are pinned to slide blocks which are screwed to receive right and left hand threaded spindles; the rotation of the latter causes the blocks to travel along suitable channel-shaped guides securely bolted to the fixed keel of the boat. The screws are operated from the inside of the boat through a differential mechanism, which also drives a drum upon which a bronze cable is coiled, thus taking an increasing share of the load as the plates approach a horizontal position. The details of the mechanism shown may be modified to control the heaviest bulbs either by hand or power. The boat keel is unbroken by slots or wells, being pierced by two holes only, for the passage of the cable and driving spindle respectively; the travel of the bulb is

in a vertical line upon either side of which the other moving parts are symmetrically distributed, resistance due to skin friction and eddy currents is not greater than that obtaining with the usual form of fixed bulb and centreboard, whilst the space occupied by the mechanism in the boat is extremely small; the submerged parts may be made of malleable bronze to obviate corrosion.

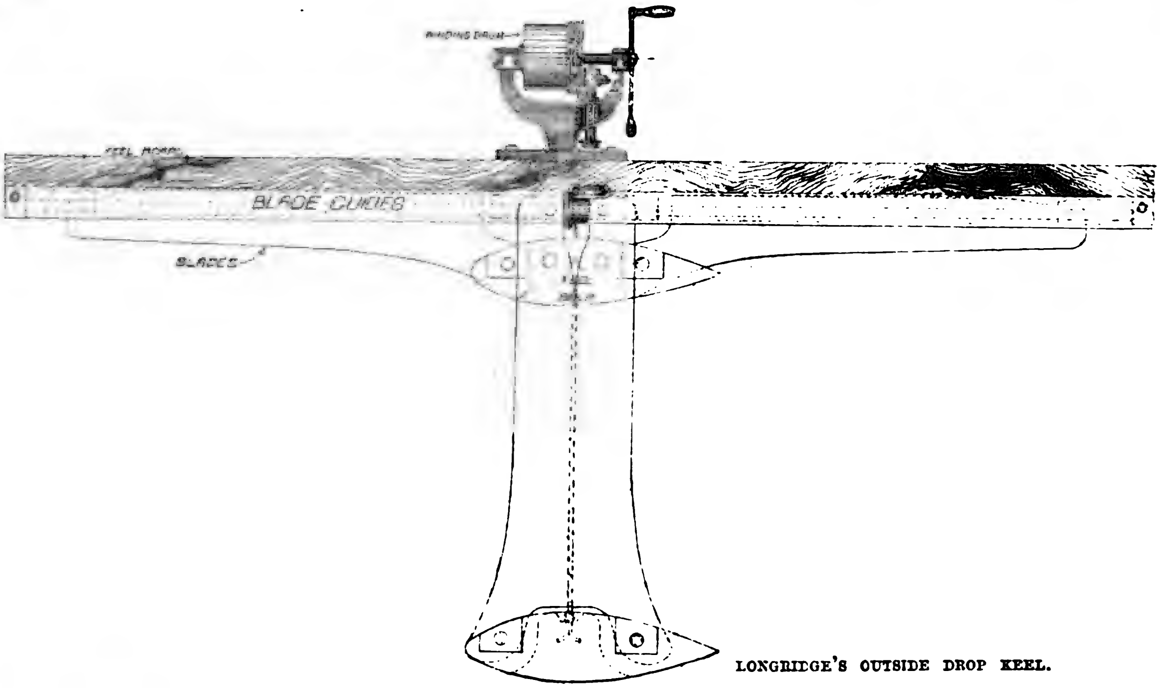
The manufacturing rights are in the hands of the Patent Axlebox and Foundry Co., Limited, Saltley Central Works, Birmingham.

THE FLEETS OF THE MAIL LINES.

THE mail lines seem busy in building. First the North German Lloyd Co. is said to be spending a vast amount of capital—exceeding that spent by the Cunard Co. in their two immense mailboats—in new vessels. The tonnage is, however, spread over no less than twelve bottoms, and, accordingly, makes less show in the eyes of the vulgar. Though recent converts to the belief in the twin screw, they are showing that they are prepared to back their convictions, for the new fleet includes twin screw boats both for the New York line and for that to China. It must, however, be noted that the New York vessels are not for the express service, but for the emigrant and steerage trades. Then the Hamburg American Line is said to have ordered in Germany two new express boats of the *Augusta Victoria* type. One is to be built by her builders at Stettin, the other is to come from a Hamburg firm who have not previously tried "greyhound" building. When they have got these vessels they will perhaps be able to maintain a regular weekly service, a thing they seem unable to do with their present fleet. Another report, however, puts these new vessels down as merely big cargo and emigrant steamers.

The winter is upon us, and Guion sailings are for the present withdrawn, as they were last year. A Liverpool paper speaks of the intention of this line to run the *Mariposa* and *Montezuma* in the service. These vessels are both steel twin screw boats of some 5,500 tons. The former was built by Armstrong's, the latter by Harland & Wolff. They were employed from their coming out two years ago till early in the present spring in the Atlantic Transport Service between the Thames and New York. Sin then the former has sailed from Liverpool to the St. Lawrence. They are undoubtedly out of a job. but there is a difficulty in the way of their employment here, for they belong to Messrs. McIver, who are temporarily debarred from the New York and Liverpool trade by agreement with the Cunard shareholders. This is said, however, to have been arranged. At all events Queenstown is to see the black funnels with their red band no more till 1894, for the Line has given notice to the commissioners that its steamers will not call there again till the spring.

The narrow seas have given us some topics to discuss. The *Leopold II.* has followed the *Marie Henriette's* example, and had a breakdown. But the *Marie Henriette* was not discouraged, and bore off the record, at least for the present, by cutting a sailing ship in two. This feat unfortunately cost the lives of all on board the sailer save one man. In speaking of so serious a casualty in a somewhat jocular manner, we must not be supposed to treat it with undue levity. But we believe these very fast paddle boats to be a mistake, and we venture to think that had she been a twin-screw steamer instead of what she is, her power of turning sharply would have avoided this lamentable accident.



LONGRIDGE'S OUTSIDE DROP KEEL.

Some people are slow to be converted to this belief, however. The Victoria Steamboat Co. is again in the market for a fast excursion steamer, and has again gone to Fairfield. Fairfield has given them some magnificent boats, but it is surely a mistake to go on building paddles. The police-court experience ought surely to tell them that the screw might save them wash (and therefore fines and costs) as well as coal bills, if they were to adopt it. It might also help them over their difficulty in getting alongside their piers.

The end of September saw the last of the Club service to Paris. Many travellers will miss the three o'clock service, but it was said not to be commercially successful. Sixteen shillings was a good deal to pay as an extra fee for it, but it surely was not that deterred any travellers who thought of using it. To a business man who has business to do in one capital to-day and in the other to-morrow, sixteen shillings is a slight consideration, especially when he is given so good a return for the outlay as a dinner *en route* and a night's rest at the journey's end. The real reason of the failure is more likely to be the fact that travellers found they could not latterly rely on the services of the *Calais Douvres* across the Channel. The P. & O. Co., however, are letting it expire gradually, for during the present month of October, when so many passengers are outward bound, they are running it every Friday for their own convenience.

The service being discontinued, there is a great attempt being

made to get the Indian mail away from the Calais route. The Belgians, with their new fleet backed by the German Railways, are said to be bidding for it, and the South Eastern Railway and the Northern Railway of France are trying to start a new service from by way of Dungeness and Treport. Whatever comes of these schemes, there is room for great economy in the mail transit between London and the Mediterranean ports. The money that is wasted over foreign railway companies would be far better in the pockets of the owners of British mail-carrying cruisers, and if it does nothing else, the agitation of the other routes may show Calais that its monopoly is destroyed, and that it must moderate its demands.

The great company of Leadenhall Street is likely to find a crumpled rose-leaf in its bed, for there is talk of a combination which shall put modern and powerful steamers in competition with its vessels in the trade to the far East. "Modern and powerful steamers" are already there, for P. & O. itself has built eight mail steamers of the finest class, and as many cargo boats equally adapted to their special work, since 1887. But though they may not be able to afford greater facilities to the public, or even to make a living for themselves, the new-comers are quite capable of doing the old company a good deal of harm if they have a sufficient backing.

A paragraph has been going the rounds to the effect that "At the request of the bondholders of the bankrupt Royal Mail Steamship Co., the Tribunal of Commerce has decided that all the steamers of the company should be sold as soon as possible." It goes on to speak of the unfortunate company as trading to Brazil, and the paragraph deserves correction, lest anyone should imagine that the British Company was the one referred to. The bankrupt concern is the Portuguese Royal Mail Line. It need hardly be said that the British West India Royal Mail Line is in a flourishing condition. It is fifty-three years old, yet it owns far more tonnage to-day than it did when it had a subsidy of the enormous amount of £304,000 a year, and it has just declared a half-yearly dividend of 30s. a share. So far as appears, it is the only steamship company of any standing which has never increased its capital, in spite of the periods of inflation and depression it has seen, and for that reason its shares are rightly considered an excellent investment.

The old Liverpool and Great Western Steamship Co.—The concern which owned the liners built before McGuin went to the Clyde for racers, is now about to close its career. The liquidator of the company has given notice that all claims are to be sent in before the last day of 1893, and now he advertises the *Nevada* as for sale by auction on the 2nd of November. This vessel, which follows her younger sisters to the hammer, was built twenty-four years ago on the Tyne. She has accommodation for some 76 first-class passengers besides 108 intermediate and a large number of emigrants.

Originally fitted with simple engines working at some 30 odd pounds pressure, she was in 1881 put into the hands of Messrs. Forrester & Co., of Liverpool, and by them given modern engines and boilers of the usual compound inverted type. She had a Kilbourn ammonia refrigerating apparatus for 2,500 quarters of beef. This, however, is to be sold separately. She is the oldest craft run by any of the mail lines between Liverpool and New York, though she is by no means the least comfortable. Many old travellers will regret her departure and the fate of the last of "Guion's brigs" will be watched with interest.

The New Australian Canadian Line has been unfortunate. The *Miowera* was their pioneer ship on the Sydney-Vancouver route, of which so much was promised and of which the promises are being more than performed. In less than five months from her opening the service she has met with disaster, when northward bound on her fifth visit to Honolulu. She is a fine steel-built steamer, launched on the 25th of July, 1892, from the yard of Messrs. C. S Swan & Hunter. It is too soon yet to know if she is to be written down as a total loss, but the fact that she was wrecked on the 2nd and that the news did not reach the continent of America till the *Australia* arrived at San Francisco with her passengers on the 18th, makes her chance of getting off very remote.

The necessity of a Pacific Cable for Imperial purposes has long been obvious, but it did not look as though the opportunity to advocate these views in the columns of THE MARINE ENGINEER would ever arrive. Now the opportunity has come, it comes through a sad calamity. The waste of capital involved in this disaster would make a fair beginning towards providing such a cable, and there is no doubt that if immediate assistance could have been sent much more chance of salvage would have been probable. Twenty-four days at least will now elapse before proper appliances reach Honolulu. In that time there is every likelihood that the vessel, already somewhat injured will be beyond help. The money will be gone and nothing remain to show for it.

The *Liverpool Courier* has the weekly shipping news very carefully collected in a column headed "Marine Notes." It is a pity that the gentleman who so ably looks after this column did not cast his eye over a little paragraph that appeared in the "Local and District" column on the 20th. There, in half-a-dozen lines, were some rather glaring errors. The work of the Queen's Island yard for the current year was referred to and the Union Liner *Goth* was spoken of as "*Gotha*" and so effectually disguised, whilst as part of Harland & Wolff's contribution to the new tonnage of the White Star Line we find the *Ionic*. This vessel is truly in the yard, but she has already travelled more than a score of times round the earth and is there for repair and renewal, not as an untried ship.

The advent of the s.s. *Magic* and the practical abolition of the Mersey bar (an absolute abolition as far as vessels of the *Magic's* draught are concerned) has resulted in an announcement that the line is to sail at a fixed hour from each end of the trip. After a few weeks' experience the post office will, we presume, give them the North of Ireland mails. If it does not do so it will be one more instance of the disregard of the department for the interests of those whom it is supposed to serve.

The new Cunarders have done well since we last noticed their performances. The *Lucania* on her second outward trip took the record from the *City of Paris* and in doing so made the best day's run yet recorded. This was 560 nautical miles, beating the *Campania*. Then coming home she lowered the *Campania's* eastward record, and for a brief space held both the eastward and the westward records. In this position she was not long to remain, for the next day the *Campania* was announced as having beaten her on the westward journey. Before proceeding to give the runs of these two notable trips it is interesting to observe that the *Times* says "The *Lucania's* best day's run on the outward journey was 560 miles, but on the homeward only 508." The poor old "Thunderer" may be still further astonished when it hears that her outward and homeward times were within 15 minutes of one another in spite of the difference in the maximum daily runs. To it these things are a mystery, but possibly the simple question of difference in time may prove a solution if it will get a board school boy to explain the problem. The *Lucania's* eastward passage was—Sandy Hook 10.19 a.m., 14th October; Daunt's Rock, 4.24 a.m., 20th; passage 5 days 13 hours 30 minutes. Runs, 38 miles to noon 14th; 480 to noon 15th; 16th, 469; 17th, 490; 18th, 500; 19th, 490; 20th, 348; speed throughout 21.01 knots.

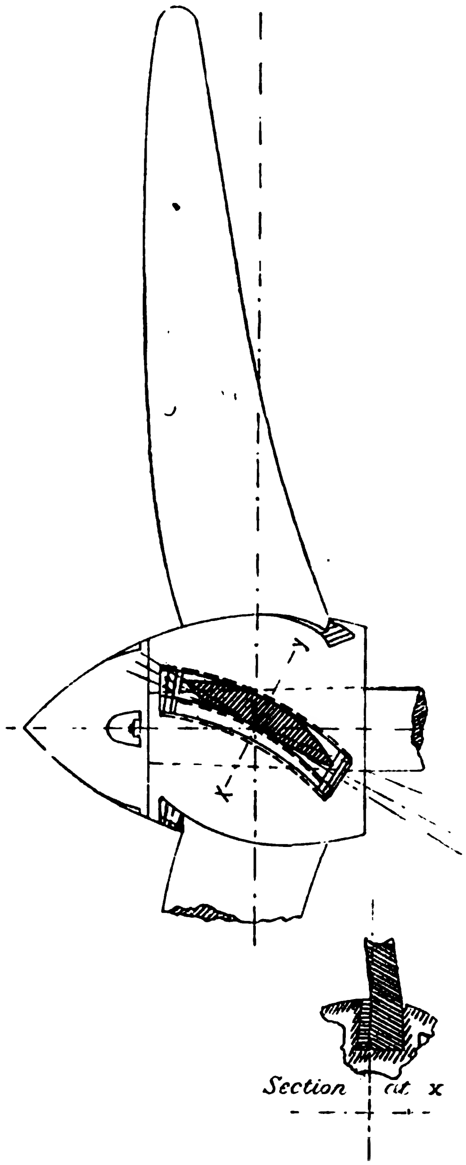
The *Campania* left Daunt's Rock at 1.37 p.m. on the 15th October, and was at Sandy Hook at 10.15 p.m. on the 20th, passage, 5 days 13 hours 23 minutes. Runs to noon 16th, 456 miles; 17th, 517 miles; 18th, 524 miles; 19th, 523 miles; 20th, 533 miles; and 2,333 miles to Sandy Hook. Total distance 2,786 miles; speed 20·89 knots. This is not as great an average speed as she has already attained on the longer course and therefore we may well look to seeing the record still further reduced in the near future.

PROPELLER BLADES WITH VARIABLE PITCH.

THE pitch of a propeller is one of those factors in the science of the naval architect and marine engineer which cannot, within the present knowledge of the arts, be fixed as an absolute and definite quantity according to the particular size and class of ship to which it is to be applied, and hence the best results are only attained as a general rule by the old-fashioned process of trial and error. Hence considerable sums of money are often spent in arriving at the best results by the change of propeller. Any device, therefore, that in any way meets this difficulty is well worthy the attention of engineers. We illustrate, in the adjoining diagrams, an invention made by Mr. J. C. Bull, which shows a novel shape of propeller blade, possessing the advantages of flanged blades in rendering the adjustment of pitch, within practically

useful limits, an easy operation, and at the same time avoids the drawbacks inseparable from flanged propellers. These drawbacks may be summarised as follows:—

1st. Excessive weight and section of boss, compared with the disc area of the propeller, particularly in the case of smaller sizes, say under 14 ft. to 16 ft. diameter.



2nd. Difficulty in setting the pitch with accuracy and varying it within close limits.

3rd. Weakness of metal at the root, in consequence of internal strains due to the contraction in different directions of the blade and the flange during setting in the mould.

The first advantage is so well appreciated that solid propellers have been the rule with few exceptions for sizes below 14 ft. to 16 ft.

The second point comes into prominence when fresh adjustment of pitch has to be made far away from workshops and proper appliances. The turning of heavy blades through fractions of degrees is a very delicate task indeed. It will be seen from the diagram the invention consists in the engagement of the blade having a curved foot of reversed wedge form, with a wedge-shaped curved slot in the boss and secured therein by packing pieces and a key or wedge. The setting of the blade is effected by the pushing of the blade along the slot to a more or less extent. It is therefore obvious that the adjustment of the blade, by pushing it along in the guiding groove, through inches or fractions of an inch, in a much simpler and more accurate operation than obtains in the ordinary flanged blade.

The third point will acquire more importance as it becomes more fully realised that the life of a propeller is not only dependent on resistence to corrosion, but as much, if not more, on its capacity for resisting millions of vibrations, involving an equal number of strains, in different directions, which vary from less than one ton to the square inch up to the limit of elasticity. Flanged blades frequently, not to say always, exhibit a deficiency as regards this power of resistance to repeated stresses, which can only be explained by the existence of detrimental internal strains at the juncture of blade and flange, due to the metal contracting in different directions during setting and cooling. The first visible signs of this structural weakness are incipient cracks which develop at the junction referred to, and increase until the blades have to be replaced long before they are otherwise worn out. This source of weakness is therefore obviated in the invention and thinner sections are rendered permissible. The blade can also be given a perfect shape from tip to root, as no heavy filleting is necessary. The boss being of a moderate size it is practicable to use loose blades for small propellers, not only without loss of efficiency, but with the prospect of a gain by varying the pitch until one most suitable for the ship has been found and fixed.

The shape of the blades renders them eminently adapted for forging in steel, Bull's metal or other malleable alloys. Blades produced in such a way are of much greater strength and elasticity than obtainable with castings, and a heavy reduction of sections is rendered possible, meaning great increase in efficiency.

Mr. J. C. Bull, of 87, Summer Street, London, S.E., would be pleased to give any further information to our readers.

H.M.S. "CENTURION."

THE first-class battleship *Centurion*, which was constructed at Portsmouth and engined by the Greenock Foundry Co., underwent her four hours' continuous steam trial under forced draught on October 6th, between the Warner Lightship and Beachy Head. The ship was under the command of Captain Burnell and Commander M'Kinstry, and the engines were worked under the superintendence of Mr. William Cairnes, by whom the whole of the machinery was fitted on board. Among others on board interested in the trial were, Mr. J. Scott, C.B., director of the firm, and Mr. E. M'Kay; Chief Inspector of Machinery, Mr. Wootton, and Fleet Engineer, Mr. Colquhoun, of the Steam Reserve; Mr. Oram, from the Admiralty, and Mr. J. T. Corner, Chief Engineer of the Dockyard. Since the previous trial of the *Centurion* a quarter of an inch had been taken from

the tops of the slide valves to admit more steam into the high and low pressure cylinders, the eccentrics had been readjusted so as to relieve the exit of the exhaust steam and increase the vacuum, and the reported leakages in the stoke-holds, which detracted from the useful work of the fans, had been stopped. There was little wind and a smooth sea. The following are the details of the four hours' steaming :—

Boiler Pressure.	Air Pressure.	Revolutions.		I.H.P.
		Starboard.	Port.	
145	1·5	105	104·5	12,954
147	1·6	106	105·8	13,581
148	1·3	105	105·6	13.010
147	1·5	104·9	105·0	13,246
146	1·5	104·4	104·3	13,494
147	1·7	104·6	104·7	13,139
146	1·7	104·6	104·7	12,766
144	1·7	103 6	103·9	13.202

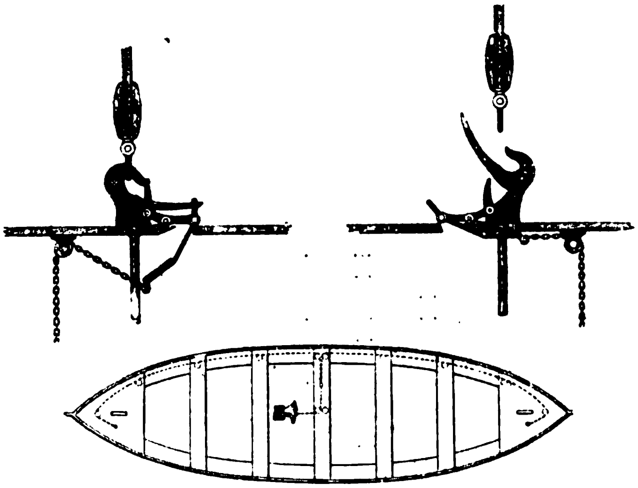
Owing to the premature commencement of the trial, and the consequent throttling of the steam, the first half-hour was somewhat disappointing and it was thrown over. There was also a falling off in the power developed during the fourth half-hour, owing to a changing of stokers, but, with these exceptions, the periodical returns were highly gratifying throughout. Subsequent calculations by the staff on board gave the appended means :—Steam in boilers, 146 lbs. ; vacuum, 27·6 in. starboard and 27·1 in. aft ; revolutions, 104·7 starboard and 104·8 port, displaying remarkable uniformity in the action of the two sets of engines ; total I.H.P., 6,401 starboard and 6,773 port, representing a collective H.P. of 13,174, or a margin of 174 beyond the contract. The mean air pressure was 1·58 in., and the coal consumption 2·24 lbs. per I.H.P. per hour. The average deep-sea speed of ship, as recorded by log, was 18·51 knots, which, though believed to be below the actual performance, is the greatest speed which has hitherto been attained by an armour-clad.

DAVITS AND BOAT DETACHING GEAR.

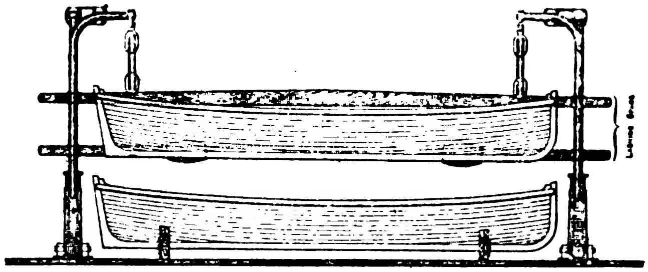
IN the adjoining diagrams we illustrate a new form of davits and detaching and picking-up gear for ships' boats, invented by Mr. James Sample, of Newcastle-on-Tyne.

The diagrams of the davits which the inventor has styled the "Invincible," are so far self-explanatory of its construction and operation as to render further explanation almost unnecessary. Special attention, however, may be directed to what is claimed as its most successful feature, namely, the position of the trunnion-heeled oscillatory jibs, which are carried in bearings placed with their axis in line fore and aft with the keel of the boat, and clear of its stem and stern. The upper ends of the jibs are curved to a position at right angles to the main body, and are inverted towards one another, terminating horizontally, the blocks being suspended there from plumb above the boats' lifting-hooks. The jibs have only one motion, that of oscillating on their trunnions outward from vertical to diagonal and *vice versa*, the horizontal position of the extremities being constantly maintained. Thus, it will be seen that the boats may be slung out-board ready for lowering, with the greatest ease (the preliminary manœuvres necessary in the use of ordinary davits to get the boats from the inner to the outer side of the davits being dispensed with) and the drawing inboard is performed with equal facility. The gear is applicable according to expediency for either one or two boats (in the latter case the boats being housed tier-fashion as shown in the diagram), this being an advantage of maximum importance on passenger and emigrant vessels where the boats are necessarily numerous, and economy of deck space a desideratum.

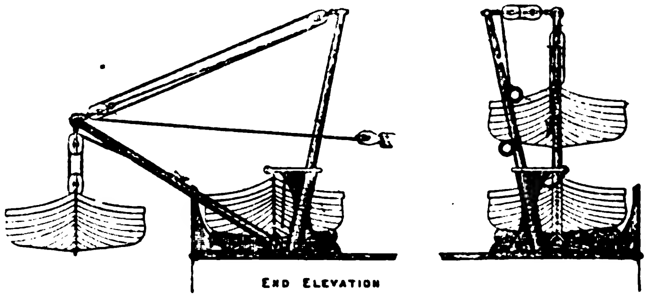
We understand that the invention has been approved of by the Board of Trade and Lloyd's Committee.



The detaching and picking-up gear for ships' boats styled the "Excelsior," as shown in the diagrams, will be clearly understood without a detailed description. It will be observed that the tumbler blocks (which are fitted with a lever arm of about 6 to 1 purchase), at the stem and stern of the boat are released simultaneously by pulling a chain placed at



SIDE ELEVATION



END ELEVATION

any convenient point, which actuates a lever with a purchase of about 5 to 1. This operation is performed with comparative ease immediately after (but not before) the boat becomes to a slight extent waterborne, regardless of the heaviest towing strain to which the tackle falls may be subject, this being an advantage that no other appliance of the kind can lay claim to.

These inventions are being put on the market by Messrs. James Sample & Co., Limited, 63, Quayside, Newcastle-on-Tyne.

THE SPANISH CRUISER.

THE Spanish cruiser *Infanta Maria Teresa*, built and engined at the Astilleros del Nervion, Bilbao, founded by Sir Charles Palmer and Don José Martinez de las Rivas, has completed her steam trials with most satisfactory results. The vessel went out of Ferrol on Saturday, October 14th, and steamed for 4½ hours under forced draught, the power developed being, as in the case of the natural draught trials, above that specified. The results are as follows:—

	Forced Draught.	Natural Draught.
Steam pressure (lbs.)	145	145
Revolutions starboard	117	105
„ port	118	106
I.H.P. starboard	6,857	4,686
„ port	6,901	4,872
„ total	13,758	9,558
Air pressure (inches)	1 in.	3-16 in.
Vacuum starboard (inches) ...	27½	27½
„ port (inches) ...	28	27½
Speed of vessel (knots)	20.15	18.5

The contract speed under forced draught was exceeded by ·15 of a knot, and the natural draught speed by half a knot, the latter, notwithstanding a heavy Atlantic swell. The mean draught of the vessel on both trials was 21 ft. 6 in., at which the displacement was 6,890 tons. The *Infanta Maria Teresa* is the first of three cruisers of similar design ordered from the new firm. The length between perpendiculars is 340 ft., and over all 364 ft., with a breadth of 65 ft. and a depth of 38 ft. For 315 ft. amidships she has an armour belt at the water line 5 ft. 6 in. broad, backed by teak. The plates, supplied by Cammel, Sheffield, are 12 in. thick. There is the usual cellular double bottom and 12 transverse bulkheads, the bunkers being also arranged to protect the machinery. These bunkers have a capacity of over 45,000 cubic feet, so that the range of action is great. The armament includes two 28 centimetre guns, mounted in barbette turrets, one forward and one aft; ten 14 centimetre guns, two 7 centimetre guns, eight 57 millimetre Nordenfelts, and 8 Hotchkiss guns. The forgings for the heavy guns were sent from England, but they were turned and finished at the Astilleros del Nervion. It was originally intended to construct the machinery at Palmer's Works, Jarrow-on-Tyne; but on the appointment, as engineering manager, of Mr. James M'Kechnie, formerly of Clydebank, it was agreed, on his proposal, that he should undertake the construction of the engines at Bilbao. Works were therefore organised. The engines are of the triple compound type, driving twin screws. The cylinders are 42 in., 62 in., and 92 in. in diameter respectively, the stroke being 46 in. The condensers have a total surface of 14,600 square feet, the tubes, over 5,000 in number, being of brass. The crank shafts are 16⅛ in. in diameter, and the propeller shaft 15¾ in. The propellers have a diameter of 16 ft. 5 in., and 20 ft. 6 in. pitch, the expanded surface being 73 square feet. There are four double-ended, and two single-ended, boilers, having in all 40 furnaces, 6 ft. 6 in. long and 3 ft. 3 in. diameter. The grate surface is 845 square feet, the tube surface 22,270 square feet, and the total heating surface 25,920 square feet. The stokeholds are closed in, forced draught being supplied by nine fans of 5 ft. 6 in. diameter. There are over 50 separate engines in the ship, all constructed at Bilbao, and the steam is supplied from a separate boiler, while a special condenser is also provided. Mr. M'Kechnie, who was present at the trial, was complimented by the special Government Commissioner from Madrid on the great success of the trials.

It is interesting to note that the shipbuilding yard and engine works at the Astilleros del Nervion were designed in the offices of Palmer's Shipbuilding and Iron Co. Limited, of Jarrow-on-Tyne, and were erected in accordance with drawings supplied by that company. The hull of the cruiser was completely designed at the Jarrow Works, and built to complete model and drawings supplied by the company, except as to some of the internal details which could only be completed on the spot. The designs of the engines were also made by the company, and except in some minor details they have been constructed in accordance with the original design and drawings supplied by them.

The vessel, with her machinery, has been built under the superintendence of the three following gentlemen, viz.:—Mr. Wilson for the shipyard with Mr. Clark as his manager, and Mr. McKechnie for the engine works, and reflect the greatest credit on these gentlemen, and it is acknowledged that no finer example of the administrative ability of the British expert can be shown. We may add that the boiler pipes and other parts of the machinery have been coated with non-conducting composition by the Carbon Cement Co., Limited, of 20, Carlton Place, Glasgow.

ENGINES OF S.S. "CATALINA."

THE s.s. *Catalina* was built by Messrs. Charles Connell & Co., Whiteinch, to the order of Spanish shipowners of Cadiz, and is intended to ply between Barcelona, Cadiz, Havana, and Gulf of Mexico ports. She has accommodation for 70 first-class passengers, 60 second-class passengers, and 300 emigrants. We see that she passed a first-rate official trial trip on July 11th, making 12½ knots at 70 revolutions indicating 2,675 H.P., with about 4,500 tons on board, though her capacity is about 7,000 tons.

She was engined by Messrs. Dunmuir & Jackson, Govan, Glasgow, and we have pleasure in giving a double page plate illustration of her triple-expansion engines in this issue, as they are characterised, we consider, by considerable elegance of design and are finished throughout in a first-class manner, and with all the latest improvements, including Weir's feed-water heater, feed pumps, evaporator, &c.

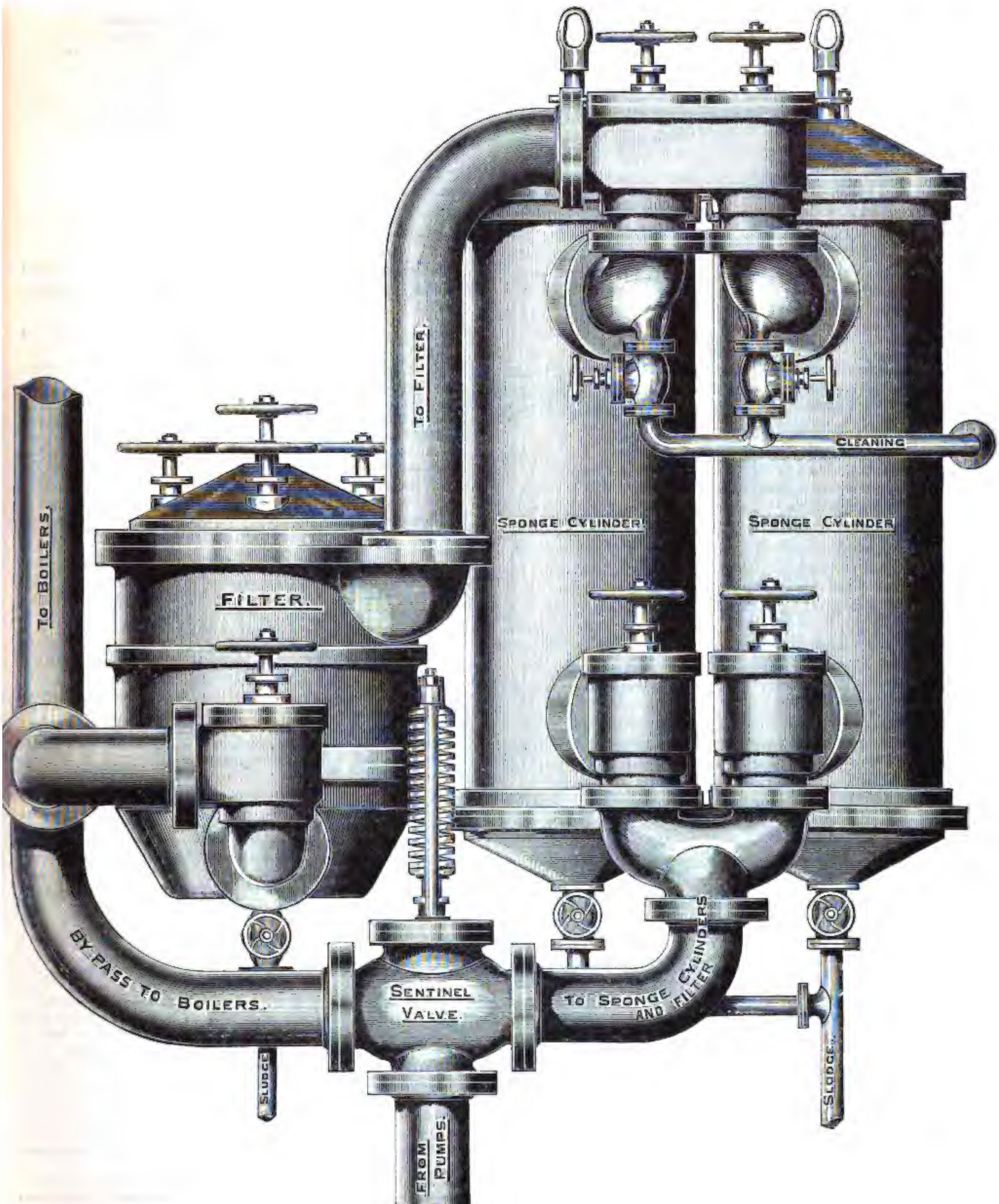
The vessel is 415 ft. length, over all; 48 ft. beam; 32 ft. depth; and 25 ft. 3½ in. draught. Her cylinders are 29 in., 46 in., and 74 in. in diameter, by 51 in. stroke. The crankshaft is 14 in. in diameter, and is fitted with main bearings of brass, lined with Kingston white metal, and all the bearings throughout have ample surfaces.

The boilers are two in number, double-ended, 15 ft. diameter, and 17 ft. long, having twelve Fox's corrugated furnaces 3 ft. 10 in. external diameter. The heating surface is 7,714 square feet, and the grate surface 252 square feet. The working pressure is 160 lbs. per square inch, which should give good economical working under triple-expansion.

The propeller is 17 ft. 6 in. in diameter, with blades of Delta bronze. On the whole, this vessel and her engines reflect great credit upon her builders and engineers.

Seamless Steel Lifeboat.—There arrived at Devonport Dockyard last month, by rail from Wakefield, a galvanised seamless steel lifeboat, known as Heslop's patent, to be supplied to the *Himalaya* troopship. The boat is to be subjected to trials during the next voyage of the *Himalaya*, and Captain Chichester is to report to the Admiralty, on his return to England, the behaviour of the boat at sea under different conditions, with a view to its introduction into the Navy.

Armed Service Steamer.—Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley, have received an order from the Government of Canada to build an armed service steamer for use on the Pacific Coast. She is to be somewhat similar to the *Quadra*, built by them for the same Government about two years ago, and is to have, as in the case of that steamer, a set of the builders' patent quadruple expansion engines. The quadruple engines of the *Quadra* have given the Government thorough satisfaction, both as regards economy of fuel and general working. The *Quadra* made the voyage from the Clyde to Vancouver *via* Cape Horn, a distance of close upon 16,000 miles, without stoppage or hitch of any kind throughout the voyage.



THE "HARRIS" COMPOUND FEED WATER FILTER (*see page* 328).

THE "HARRIS" FILTER.

We have pleasure in placing before our readers two illustrations of the "Harris" filter, as supplied to the *Lucania*, by Messrs. Copley, Turner & Co., of Middlesbrough. The filter and its connections form the most complete and the largest installation for feed filtration that has yet been manufactured. It has to treat not only the condensed steam from the main engines, but also from the numerous auxiliary engines and pumps, all of which contribute their quota of grease and impurity. The total amount of water dealt with exceeds 5,000 tons per day, or 60,000 tons for the run from Liverpool to New York and back again; the entire contents of the boilers being converted into steam and passed through the engines and condensers, and feed water filter five times every twenty-four hours. Referring to the larger illustration, the water is passed first through cylinders fitted with a series of perforated diaphragms, between which is closely packed prepared sponge of great toughness and durability, through which the water passes, depositing its coarser impurity, and then into the filter proper, where the remaining impurity is extracted. The sponge lasts for a voyage and has to be replaced at a cost of 15s. The area of the filtering medium in the filter proper is 127 times the area of the feed pipe, and the layers of filtering medium are so arranged that each receives and treats a separate quantity of the feed water independently of the others, and a large dirt chamber is provided at the bottom, in which the dirt rejected by the filtering medium settles. A sentinel bye-pass valve is fitted upon the main feed pipe, by which the desired amount of friction through the sponge cases and filter is regulated at will, the spring merely giving sufficient pressure to direct the water through the filters rather than allow it to pass direct to the boilers. The sentinal valve is arranged with an electric bell contact attached to the spindle and a bell placed near the starting platform. When the filter becomes foul the friction through the medium increases until the pressure exceeds that of the spring of the sentinel valve, when it opens and allows the water to pass direct to the boilers. The operation of the valve however, automatically rings the bell, and warns the attendant that the filter requires attention. He then closes the inlet valve, opens the sludge valve, and the water passes back through the egress valve, washing out the dirt chamber, and cleanses each medium independently of the rest, this being effected in such a way that the dirt is not merely conveyed from the face of one medium to the back of the other. To complete the cleansing steam is now passed through the filter by the valve provided for the purpose, and in this way the more refractory grease is scalded off. The sludge valve is now closed and the inlet opened and the filter works as before. To cleanse the sponge cylinders the inlet and outlet valves are closed, the diaphragms raised by the screws provided for the purpose, and the sponge is tightly squeezed between them, and the grease extracted and floated off; steam being admitted as in the other case to complete the operation. The diaphragms are then lowered and the valves opened and the water allowed to pass through them again.

In practice it has been found that the "Harris" filter only requires reversing to clean once in 24 hours, notwithstanding a large amount of dirt is extracted, and the filter makes the full run out to New York and back to Liverpool without being opened out to renew the medium. In the *Lucania* as in the *Campania*, the boilers were opened out, both on arrival at New York and on the return to Liverpool, and were found to be absolutely free from grease and other deposit. The smaller illustration shows the "Harris" compound feed filter, of which a very large number are being fitted to steamships, and in which the dual operation as above described is carried out in the one machine.

A DESCRIPTION OF THE NEW SAND DREDGER "BRANCKER" FOR THE MERSEY DOCKS AND HARBOUR BOARD.*

By A. Blechynden, Naval Construction and Armaments Co., Barrow-in-Furness.

In dredging a fluvial or marine deposit of reasonably clean, sharp sand, such that, at a low velocity, it readily deposits and flows or lifts in a stream of high velocity, the most easy and convenient method seems to be by pumping. The Mersey Bar is of such a nature. And it has been successfully so treated, upon a fairly large scale, for a period of two and a half years, the Mersey Board having two dredgers, one with a suction tube 18 in. in diameter, and the other 22 in. in diameter.

2. At first difficulties were encountered and met by the Board's engineering staff, so that the most unqualified success has recently attended the dredging operations.

These encouraging results have induced the Board to extend the system to an experiment upon a larger scale, towards which end the *Brancker*, which is the largest dredger in existence, has been built by my company, and it has been thought that a description of it might be interesting to the present Congress.

3. It is a hopper dredger, designed with the view of lifting sand, at the rate of 4,000 tons per hour. Its hoppers have a capacity of 3,000 tons of wet sand, and it is fitted with twin-screw engines capable of propelling it at a speed of 10 knots per hour when loaded.

4. The design of the machine will be readily understood from the illustrations respectively, the profile of the vessel, and profile and plan of the, machinery and hoppers.

Its length over all is	...	...	320 ft.
Its breadth moulded	...	...	46 ft. 10 in.
Its depth ...	...	...	20 ft. 6 in.

Its draught is 16 ft. 4 in. when loaded and equipped.

There are eight hoppers, four in the direction of its length, arranged along its sides, with a well for the suction tube between the two sets of four.

The pumping machinery is at the forward end of the well, the propelling machinery and the boilers aft.

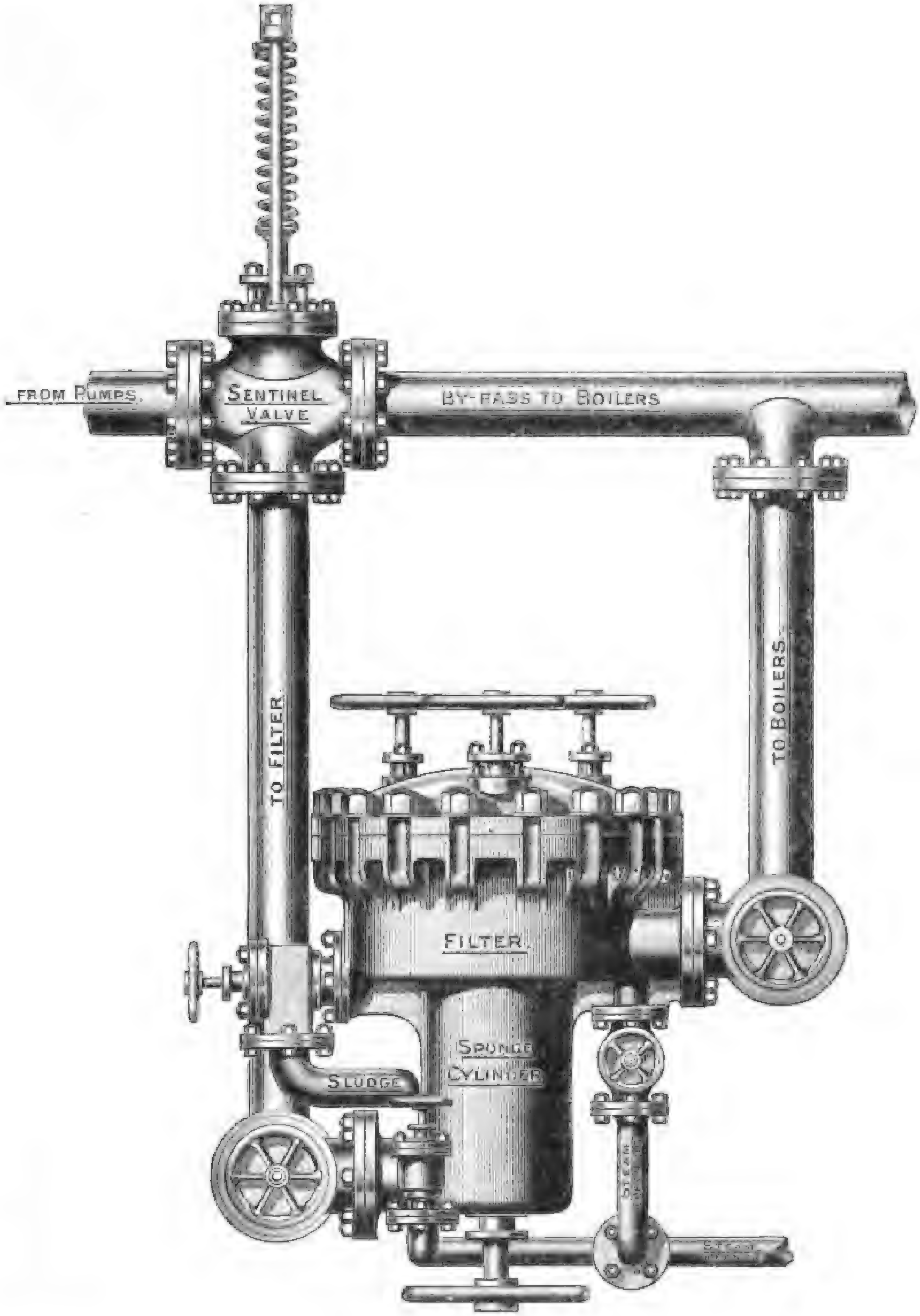
The sand-pumping machinery consists of two centrifugal pumps, having 36 in. suction and delivery pipes, each worked by a three-stage expansion engine.

The pumps are situated one at each side of the well and draw from a T head at the top of the suction tube; this T head also serves as a trunnion or hinge round which the tube can swing so that it can be raised or lowered to suit varying depths of water, and also the depth to which the machine is to dredge. The suction tube is also fitted at its upper end and close to the T head with a ball-and-socket joint, which serves to give a certain amount of lateral motion, and so to obtain lateral support for the tube by the sides of the well and remove any transverse stress from the head of the tube. The suction nozzle, it will be observed, has its aperture almost at right angles to the axis of the tube; it is fitted with a grid to prevent material of such a size as would choke the pump passing through it.

Each centrifugal pump is so arranged that it may be disconnected from the main suction pipe, so that in case of breakdown the other pump may be worked alone.

The main suction tube is raised and lowered by hydraulic

* Read at the International Maritime Congress.



The "Harris" Compound Feed-Water Filter (*see page* 328).

lifting apparatus, and is also fitted with preventer chains and other gear, so that in case of accident it may be lifted by means of tackle led to one of the deck winches.

5. The mixture of sand and water is delivered along two "landers," one opposite the delivery of each pump, so that the port and starboard sets of hoppers have each their own, and the material is discharged into the hoppers through apertures with regulating doors at their bottoms.

By experience it is found that these may be so fixed for a given quantity of material, so that all the hoppers may be filled simultaneously, the openings to the first two being made very small, and the others increased as the distance from the delivery pipe to the pump increases.

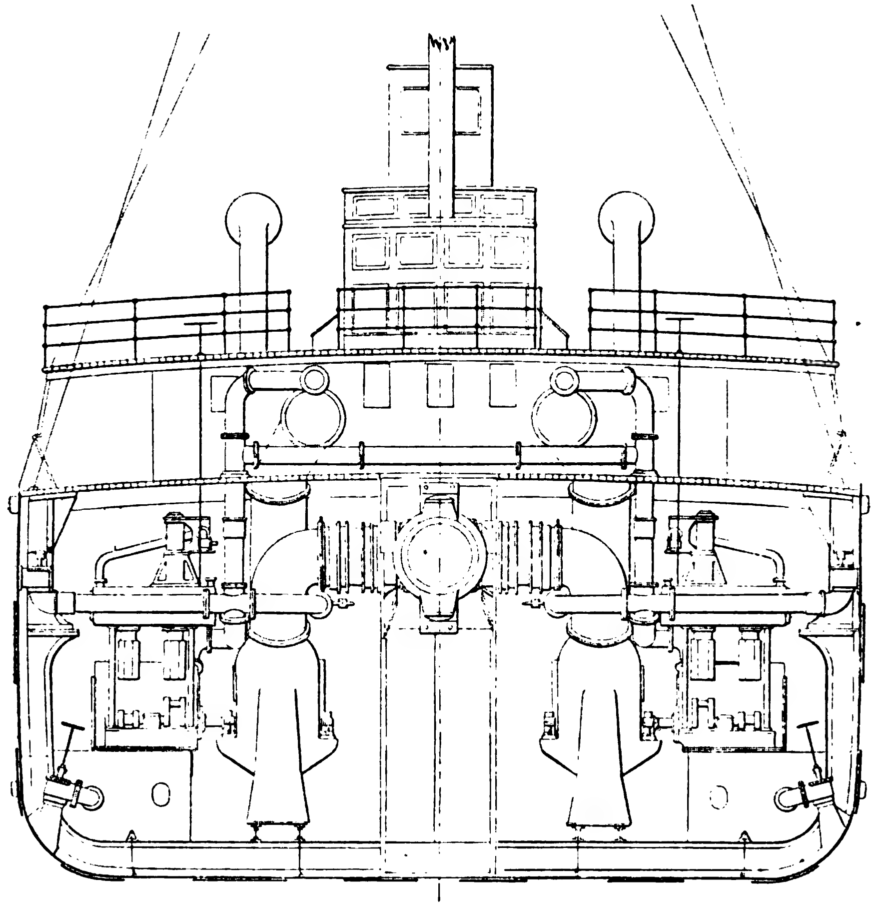
6. The hopper-discharging apparatus is of a very novel character, and is the patented design of Mr. A. G. Lyster, assistant engineer to the Mersey Dock Board.

Each hopper has one discharging door or aperture in the centre

The supplies to the centre, bottom, and top of each are each fitted with independent throttle valves, whose handles, with that for the hydraulic lifting gear for the discharge valve, are arranged close together for each hopper, and are worked from a fore and aft bridge, of which there is one extending from the boiler casing aft along to the pump-room forward on each side of the central well.

The controlling gear for the suction tube and the speed of the sand pumps is in a small house on the steering-bridge, where there are also indicators to show the depth of the nozzle below the vessel's keel, the pressure on the hydraulic main, the vacuum on the suction tube and telegraphs to the pump room.

It is very important that some automatic apparatus should exist in a machine of this kind, by means of which the tube may be balanced, or partially so, in order that with the ebb of the tide its end should rise or should fall as the sand is removed from its vicinity during the process of dredging. To meet this require-



of its bottom, towards which the bottom slopes from all sides. This aperture is closed by a valve, which opens upwards, and is surmounted by a slightly tapered trunk, which extends upwards to the top of the hopper. The sand is cleared out of the hoppers by means of water, which is supplied through the centre of the discharging valve, and is ejected through an annular aperture about 5 in. above its bottom, through a set of pipes which are fixed around the sides of the hopper and about 15 in. above the junction of the bottom and the sides; the water is ejected in a series of jets from these pipes inwards and downwards at about an angle of 45° with the vertical, and through a "lander" which extends around the three sides of the hopper coamings which are away from the main "lander"; this is an auxiliary only, and in case of need water may be supplied to these from the main "lander" and discharged through a series of circular holes in its bottom.

The central and lower pipes receive their supplies from the circulating pumps of the propelling and pumping engines, which are made specially large for this reason.

ment the steam and hydraulic accumulator has been utilised as a balance for the tube. The steam to the cylinder passes through a reducing valve fitted so that it be used either as a reducing valve, or by pulling over a lever in the controlling house the valve ceases to act and the full steam pressure is applied to the accumulator cylinder, and the tube may be lifted.

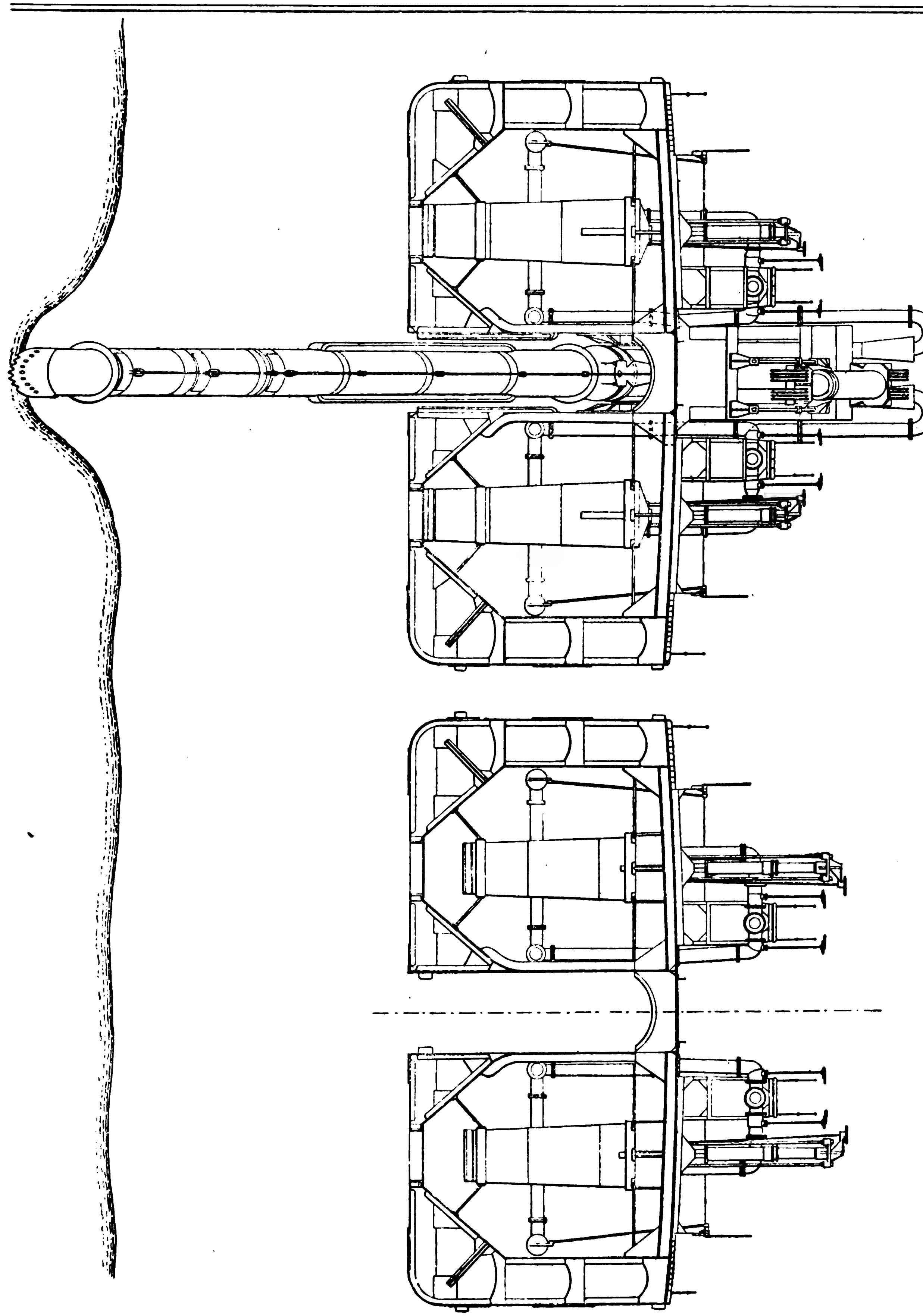
The pumping engine for the hydraulic gear is a two-cylinder compound engine with the usual double-acting pumps.

The propelling machinery consists of three-stage expansion engines working separate screws. The working pressure is 180 lbs. per square inch.

There are on deck a couple of steam winches and a powerful steam windlass for the anchors.

The vessel is fitted with a rudder at stem and stern, both of which can be worked by steam or hand.

The vessel is divided into three watertight compartments forward and three aft of the hoppers, exclusive of the peaks, and the hoppers are independently built within the hull of the vessel, thus forming between themselves and the outside and the bottom



THE SAND DREDGER "BRANCKER" FOR THE MERSEY DOCKS AND HARBOUR BOARD (see page 328.)

other eight compartments; the after part of the double bottom beneath the hoppers is used as a fresh-water tank for the boilers.

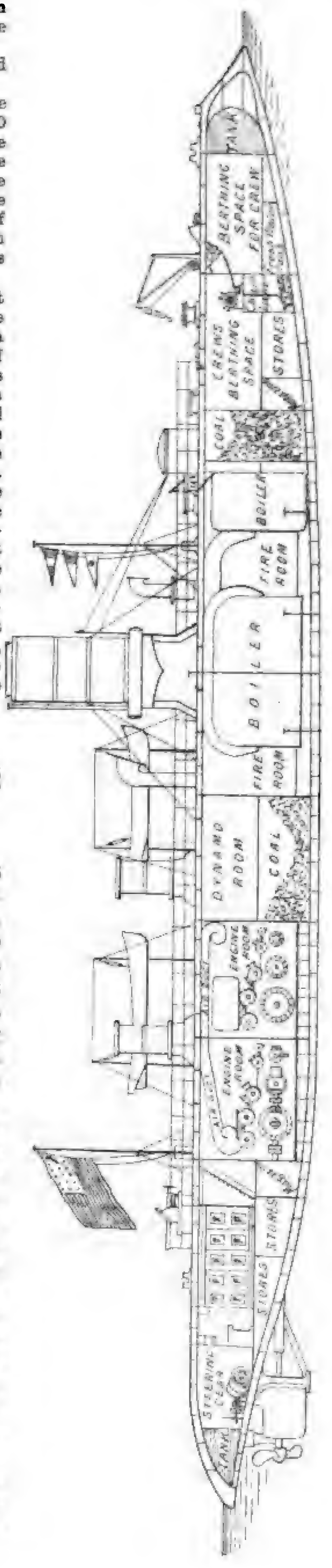
Quarters are provided for the officers and crew in the poop and forecastle.

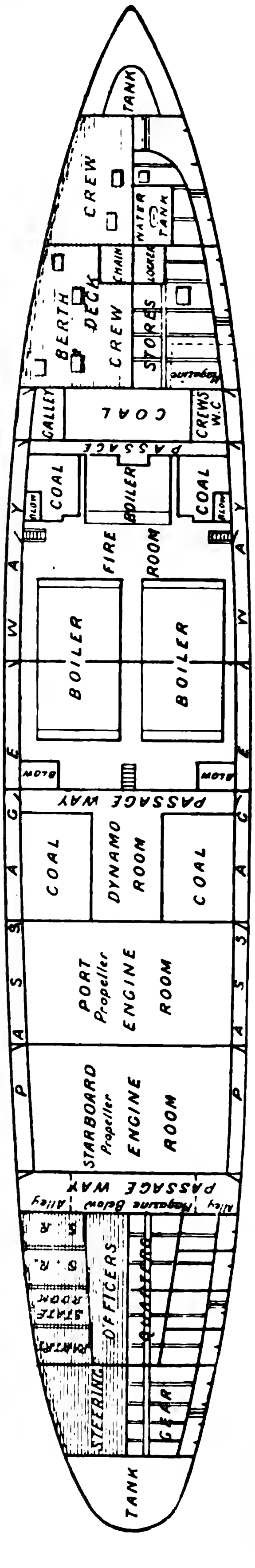
On the trials on the Mersey Bar the hoppers were for some time filled at the rate of 100 tons per minute, or equal to 6,000 tons per hour. In another trial the time from the start to charge the tube until the hoppers were full was 39 minutes, or at the average rate of 4,620 tons per hour. On the official trial the hoppers were filled with 3,000 tons in 43·4 minutes, or at the rate of 4,150 tons per hour. In this case, however, the character of the sand was very different from the average, the result of which was a loss of 10 per cent. in the overflow against an ordinary loss of not over 2 per cent.

In so gigantic an experiment as this it was not looked for that success would be immediately secured, consequently during the progress of the design the way was very carefully felt, and a considerable number of experiments were made with hoppers of different sizes so as to determine the most satisfactory proportions of valves and the necessary quantities of water for sludging, with the result that when a pair of the hoppers were ultimately filled up with such arrangements as our experience with models suggested as suitable, it was found, on trials made from May 18th to the 27th, that practically no modification was found needful. It will, however, be unnecessary to say that, although the machine has been pronounced most successful, there will doubtless be points discovered in continued working which may suggest improvements in case of a reproduction of the machine. One might be the policy of reproducing so large a hopper dredger, as there are many arguments, and of a powerful character, in favour of a separate dredging plant with hopper tenders. These were, however, given full consideration by the Board's advisers in the light of their past experience before the *Brancker* was contracted for, and the balance of advantage was held to be in favour of the one vessel; whether this is upheld by further experience remains to be seen.

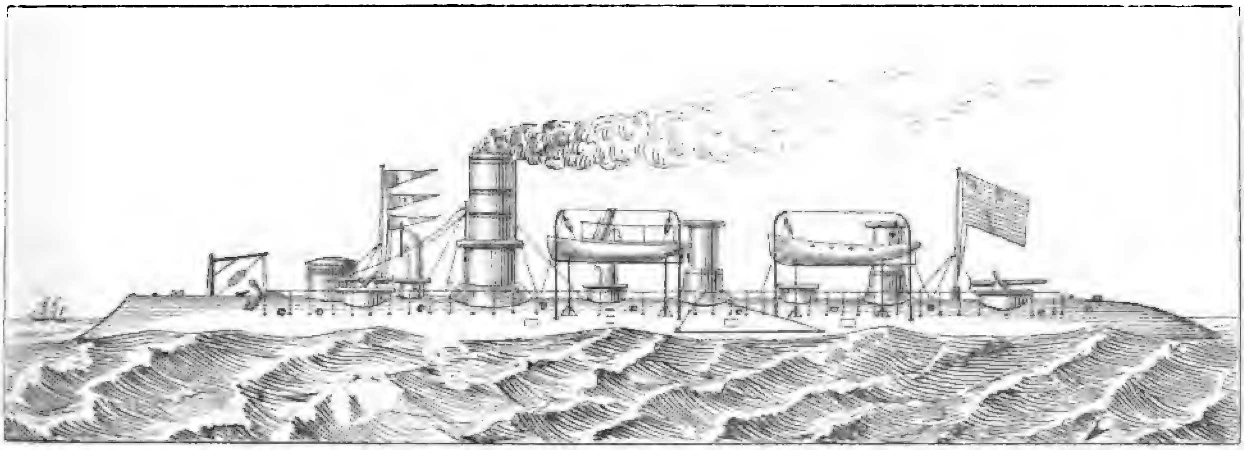
THE UNITED STATES ARMOURED HARBOUR DEFENCE RAM "KATAHDIN."

ONE of the most interesting and unique crafts at present in the course of construction is the U.S. Ram *Katahdin*, of which we give four illustrations, longitudinal section, plan at water line, amidship section, and a view of the vessel on the water, now rapidly approaching completion at the yard of the Bath Iron Works, Bath, Maine. She is in reality an experiment ship, her designer being Rear-Admiral Ammen, U.S.N., and although it is claimed that she is purely American, her model is very similar to that of the British torpedo-boat, *Polyphemus*. The power of the ram when successfully aimed has been clearly demonstrated in the destruction of the *Re' d'Italia* by the *Ferndinand Max*, at Lissa, in 1866, and in the disastrous collisions between the *Thetis* and *Reine Blanche*, the *Iron Duke* and *Vanguard*, the *Konig Wilhelm* and *Grosser Kurfurst*, and the more recent *Victoria* and *Camperdown*. The general dimensions of the *Katahdin* are as follows:—Length overall, 251 ft.; length on normal water line, 250 ft. 5 in.; extreme breadth, 43 ft. 5 in.; breadth at water line, 41 ft. 10 in.; depth amidships, 21 ft.; depth at knuckle, 14 ft. 5 in.; draught amidships, 15 ft.; displacement, normal, 2,185 tons. The vessel is constructed upon the longitudinal and bracket system, with an inner bottom extending from the collision bulkhead to the stern. The longitudinals and girders supporting the deck are continuous converging to the 14 ton stem casting and stern; the transverse frames

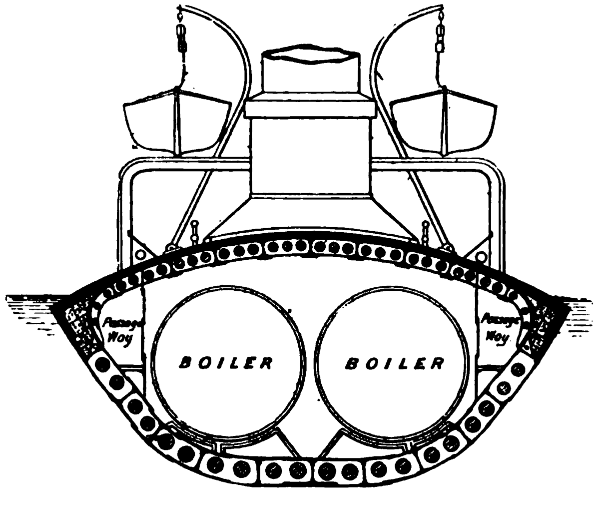




and beams being intercostal. The depth of the longitudinals and vertical keel throughout their length is 24 in.; the girders supporting the armoured deck having a depth of 15 in. Two longitudinals and armour shelf on each side of the vertical keel are watertight, forming six fore-and-aft compartments, these being divided transversely by watertight frames spaced about 20 ft. apart, and by this means the space between the inner and outer skin is subdivided into 72 compartments. The transverse and longitudinal bulkheads between inner shell and armoured deck divide this space into 30 more compartments, making a total of 102 watertight compartments on the vessel. The keel of the *Katahdin* is elliptical, which gives better lines for propulsion and greater facility for turning and manœuvring. The cross sections are also elliptical, being sponsoned out so as to make good lines for deflecting projectiles and sharp edges which after ramming will serve to rip out the forward part of a vessel struck on the sides, and crash in the fulcrum when the vessel has struck headway. For protection the vessel is fitted with two strakes of side armour, the upper being 6 in. thick for a length of 150 ft. amidships, and 3 in. at each extremity, whilst the lower has a uniform thickness of 3 in., the whole being firmly secured to 3 ft. of Georgian yellow pine and two steel backing plates. The outside strake of the deck armour is 6 in. in thickness, the next strake inboard tapering in thickness in its breadth from 5¼ in. to 2½ in., the remainder of the deck being 2½ in. thick including the lower course of plating. All the hatches through the main deck are fitted with battle plates and the smoke pipe and ventilators have inclined armour 6 in. thick. The propelling engines of this remarkable craft are placed in watertight compartments separated by an athwart ship bulkhead, the port engine being placed forward of the starboard one. They are of the horizontal direct-acting triple-expansion type, with cylinders 25 in., 36 in., and 56 in. diameter, by 36 in. stroke, designed to develop 4,800 H.P. with 150 revolutions per minute. The main valve is of the piston type, worked by Marshall valve gear, and there is one piston valve for each high pressure and each intermediate, and two for each low pressure cylinders. The bed plates and cylinders are secured together by forged steel tie rods and supported on wrought steel foundation plates built in the vessel. The crank, thrust and propeller shafting is hollow, and the shaft, piston and connecting rods, and working parts generally are forged of mild open-hearth steel. The condensers are made of composition and sheet brass, the air and circulating pumps being independent, and the propellers, which have a diameter of 10 ft. 6 in., are constructed of manganese bronze. Each engine-room has an auxiliary condenser with combined air and circulating pumps, and independent boiler feed pumps are placed in the fire rooms. Steam for the working of the engines is supplied by two steel double-ended cylindrical Scotch boilers, 22 ft. 6 in. long by 13 ft. 6 in. diameter, and one single-ended 11 ft. 6 in. long and 13 ft. 6 in. diameter. There are 15 furnaces with 354 square feet of grate surface, whilst the heating surface is 12,150 square feet, and the working pressure—Government limit—168 lbs. The boilers are placed in two watertight compartments with one common smoke pipe of 8 ft. diameter, the single-ender surrounded by coal-bunkers being forward of the other two. The forced draught system consists of two large Sturtevant blowers for each fire-room, delivering into an air-tight stokehole. At normal draught the vessel will carry 180 tons of coal, but she has a bunker capacity for 237 tons, which at 10 knot speed will give her an effective radius of action of about 2,400 knots and an endurance of 10 days. The vessel has a complete distilling apparatus for reducing salt water to fresh, and a machine for making artificial ice with a capacity of 500 lbs. daily, whilst an engineer's workshop, fitted with lathes, drilling machines, &c., is another very important feature. An elaborate system of artificial ventilation is fitted on the exhaust plan; the vitiated air which is withdrawn by fans being replaced by fresh air supplied through ducts connected to the armoured ventilators. There is a complete installation of electric lights—including a powerful search light of the "Mangin" type—sufficient for lighting all parts of the vessel, and arranged in duplicate so as to guard against accident, the plant consisting of two engines and dynamos placed in a common watertight compartment above the forward engine-room. The drainage and piping system is very



complete and so arranged that any compartment can be pumped out by steam. The vessel will be submerged to fighting trim by means of fourteen 8 in. Kingston valves, one in each transverse watertight compartment of the double-bottom, and sluice valves are fitted in the vertical keel and water-tight longitudinals in these spaces; a large trimming-tank extending from the keel to the main-deck is also fitted both forward and aft. For controlling and navigating the ship, a conning tower, 6½ ft. high and 8 ft. diameter is fitted, constructed of nickle steel armour plates 18 in. thick, and inside this the various telegraphs, steering-wheel, voice-pipes, &c., are placed, having communication with all parts of the ship. Four boats are carried on raised skid-beams amidships, viz., one 28 ft. steam-launch, one 28 ft. cutter, and two 29 ft. whale-boats. Steam-steering gear of the "Williamson" type and a steam capstan and windlass of the "Hyde" patent are also carried, and the vessel is fitted with all modern



approved appliances for the convenience and comfort of her crew. The ship's complement consists of 7 officers, 28 sailors, and 56 in the engineering corps, including firemen, coal-passers, &c., and the berthing spaces for the crew forward, are spacious, well lighted and ventilated. The officers ward-room is on the after berth deck, just abaft the engine-room bulkhead, into which opens seven staterooms and a pantry, whilst, aft of all, is the captain's sumptuously furnished quarters. The joiner work and general furnishings of these aft cabins is magnificent, being worthy of special comment, the highly-polished cherry and ash walls showing to the best advantage with the white china gloss ceilings. The armament or batter yof the *Katahdin* consists of only four 6-pounder rapid firing guns, mounted two forward and two aft in armoured barbettes, but she is in reality her own weapon, and when she makes her impact at 17 or 18 knots she will strike a blow of 400,000 ft. tons, a force capable of sending any armoured craft that floats immediately to the bottom.

Erratum.—In our description of a Novel Tighteuing Device for Journals, published in the October number of this journal, the address of Messrs. Browett, Lindley & Co., Limited, should read ıdon Works, Patricroft, Manchester, they having at present no don address.

"THE JAUREGUIBERRY."

THE magnificent battleship *Jauréguiberry*, which was launched on Friday, October 27th, from the yard of the Forges et Chantiers de la Méditerranée at La Seyne, near Toulon, in the presence of an assemblage such as rarely attends even the most important public function, bears the name of the great French admiral who, at the age of 72, died in 1887, and whose son commands the first-class cruiser *Alger* in Toulon Roads. The ship, which, when completed, will rank among the most powerful vessels of the French navy, and is sister to the *Charles Martel*, launched in August last, and the *Lazare Carnot*, now under construction at the Government yard at Le Mourillon, across the Bay, was laid down on November 23rd, 1891, and has been, therefore, not quite two years upon the stocks. No French battleship of the first class has hitherto been built with anything approaching the same celerity. The plans were drawn by M. Lagane, a naval instructor to whom Brazil owes the *Solimoes*, Spain the *Pelayo*, Chili the *Capitano Prat*, and France several war vessels of the most modern and efficient types. The new ship marks the latest and most perfect developments of ideas which were first adopted for the *Pelayo*, launched in 1886, and which were improved upon in the designs of the *Capitano Prat*, launched in 1890. The *Jauréguiberry* as yet has very little of her armour on her, and, being also without guns, engines, or fittings, probably weighs no more than about 3,500 tons; but, when completed for sea and loaded to her normal waterline, she will displace 11,818 tons of water, and will therefore rank in size with our *Trafalgar* or *Nile*. Her lines are so fine, and so different from the majority of French battleships, that she looks rather like a fast cruiser than like a ship of the line. The stem, gently curving outward, as in the case of most of our own vessels of late date, fails altogether to recall the characteristic boot-toe form of the bows of the majority of French ironclads; and the forecastle, instead of being "à plage," is not only high, but actually a deck higher than the after part of the ship. The problem which was undertaken by the designer was to combine in a vessel of less than extreme size great speed with high gun-power and as complete protection as it was possible to give.

The ship is 356 ft. long by 72 ft. 6 in. broad, and from the keel to the upper deck measures 47 ft. 10 in. The draught aft will be 27 ft. 8 in. Two triple-expansion engines will each drive a manganese bronze screw, and steam will be furnished to them by 24 groups of boilers of the Allest and Lagrafel type, tested to 33 lbs. pressure. With natural draught a total of 13,000 H.P. is contracted for. This will give a speed of about 17 knots. With forced draught and a development of 14,200 H.P. the speed should somewhat exceed 17·5 knots.

The guns are arranged exactly as in the *Capitano Prat*, though they are, of course, of much heavier calibre. The main armament consists of four big guns, disposed lozenge-wise, each in a separate covered turret. Those on the quarter-deck and forecastle are each 11·8 in. 44-ton guns. Those on the beams are on sponsons, and are each 10·8 in. 34-ton guns. All the other guns are quick-firing ones. On either side, a little astern of the forward turret, and again a little forward of the after turret, is a small turret containing a pair of 5·4 in. 3-ton guns. In addition there are on the upper deck and superstructure, and in the tops on the military masts, four 2·5 in., twelve 1·8 in., and eight 1·4 in. guns. There are also six torpedo ejectors, of which two are submerged.

The armour includes a 17·7 in. end-to-end belt at and below the waterline. This is brought down forward to the level of the point of the ram, and is surmounted by a belt of 3.9 in. armour, which protects the slope and edges of the armoured deck. This deck, which is of steel, is 2·75 in. thick, and the armour of the large turrets is carried right down to it. The principal turret armour has a thickness of 15·7 in. The 5·4 in. guns are behind 3·9 in. armour. All the eight turrets are constructed upon M. Lagane's balanced system, and, no matter the direction in which they may be trained, the trim of the ship is not appreciably altered. This is an important improvement. During the last manœuvres the *Benbow* very markedly heeled over when her two 111-ton guns happened to be trained simultaneously on one beam. The heel was sufficient to raise the armour on the other side entirely out of the water, and to expose the ship's unprotected bottom to any light guns which might be brought to bear upon it. Such a state of affairs would, especially in a fleet action, be a dangerous source of weakness, and M. Lagane has shown how it may be avoided without making any material addition to the weights. The

entire armour of the *Jauréguiberry* will weigh nearly 4,000 tons, and will cost about £320,000, which is, roughly, the price of a large second-class cruiser or of a fast Atlantic steamer of the best type. The normal coal capacity is 800 tons, but it can be, if necessary, considerably increased. The complement will be 650 officers and men.

A remarkable feature of the *Jauréguiberry* will be the extensive use of electricity as a motive power. It will move the turrets, raise the ammunition, and do much other work which in the majority of modern ironclads is done by steam or by pneumatic or hydraulic power. It will also, of course, light the vessel. The ship will contain 550 incandescent lights, and there will be six very powerful Mangin search lights. The total cost will, it is estimated, be about £920,000. The following is a comparison of some of the leading details of the *Jauréguiberry* with those of certain modern battleships of about the same displacement belonging to other Powers:—

——	France. *Jauréguiberry.*	England. *Nile, Trafalgar.*	U. States. *Iowa.*	Russia. *Three Saints.*
Displacement, tons	11,818	11,940	11,286	12,480
Length, feet ..	356	345	360	357·5
Beam, feet ..	72·5	73	72	72·1
Draught, feet ..	27·6	27·5	24	26·6
I.H.P.	14,200	12,000	11,000	10,600
Extreme speed, knots	17·5	16·5	16·5	16·0
	2—11·8in.	4—13·5in.	4—12in.	4—12in.
	2—10·8in.	6—4·7in.	8—8in.	8—6in.
	8—5·4in.	8—2·2in.	6—4in.	4—4·7in.
Guns	4—2·5in.	9—1·8in.	20—2·2in.	8—2·2in.
	12—1·8in.	7—mach.	6—1·4in.	8—1·8in.
	8—1·4in.	—	2—mach.	—
	6 tubes.	6 tubes.	7 tubes.	7 tubes.
Armour, inches—				
Belt	17·7	*20·0	14·0	16·0
Battery ..	3·9	*16·0	5·0	?
Turrets ..	15·7	18·0	15·0	12·0
Deck ..	2·7	3·0	3·0	2·7

* Partial and local only.

It is true that the weight of broadside of the *Jauréguiberry* will be less than that of any of the ships with which she is compared. On the other hand, she is so arranged that she can fire two 11·8 in., one 10·8 in., four 5·4 in., two 2·5 in., six 1·8 in., and four 1·4 in. guns simultaneously at any point on either beam, and can bring to bear upon any point ahead or a stern one 11·8 in., two 10·8 in., and four 5·4 in., besides smaller guns. In this respect, as well as in the important quality of speed and in general completeness of protection, she seems to be greatly superior to the other vessels.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our own Correspondent.)

The Battleships of the Defence Act.

THE delivery of the *Royal Oak* from Messrs. Laird's, and the *Revenge* from Messrs. Palmer's, completes the contract building work of the Naval Defence Act of 1889. Of the ten battleships, *Royal Sovereign, Empress of India, Ramillies, Hood, Centurion, Resolution, Revenge, Repulse, Royal Oak* and *Barfleur*, the first four are already in commission, two in the Channel and two in the Mediterranean. The three next in the list will also hoist the pennant very shortly, leaving three more to be completed early in the new year. The average period occupied in the construction of these huge vessels is three years, which is not only most creditable and satisfactory, but is also bound to be more economical in the long run than the old practice under which ships of this class were sometimes six and even seven years in building. It is rumoured that a programme is in preparation at the Admiralty for next year, which will include the commencement of four battleships of somewhat similar design to the *Centurion* class, and that the construction of one of these four vessels will be offered to each of the following firms:—Sir W. G. Armstrong, Mitchell & Co., Messrs. J. & G. Thomson, of Clydebank, Messrs. Laird, of Birkenhead, and Messrs. Palmer, of Tynemouth. It is also stated that the new cruiser *Powerful* is to be built at Elswick.

Portsmouth Dockyard.

There is plenty of work in the yard for some time to come, although not so much as could be wished, for the various jobs of constructing, completing and repairing do not fit in as well as they should. Of building, there is only the *Fox* in hand, until the *Eclipse* and *Majestic* are started, which should soon happen. The drawings of both ships have been received, and the latter is to be constructed in No. 13 dock, where the *Royal Sovereign* was built. The four ships, *Resolution, Revenge, Repulse* and *Royal Oak*, will have to be completed, but two of them will be out of the way before Christmas. The *Ramillies* has been commissioned, and the *Centurion* will be ready for the pennant before the end of the year. The *Royal Sovereign, Vulcan, Active* and *Volage*, commissioned ships, have completed their refits and left; the *Rodney* will follow them. The *Sultan* is ready to be taken in hand, and a contract for her machinery has been made; her outside plating is on, and the work of fitting the interior should soon be under weigh. During the eight and forty hours the Lords of the Admiralty spent here, it is said that they sanctioned the scheme for the extension of Whale island, but it must be years at least before new buildings can be erected on the reclamation ground, which is now being filled up with the earth excavated from the new docks.

Launches.

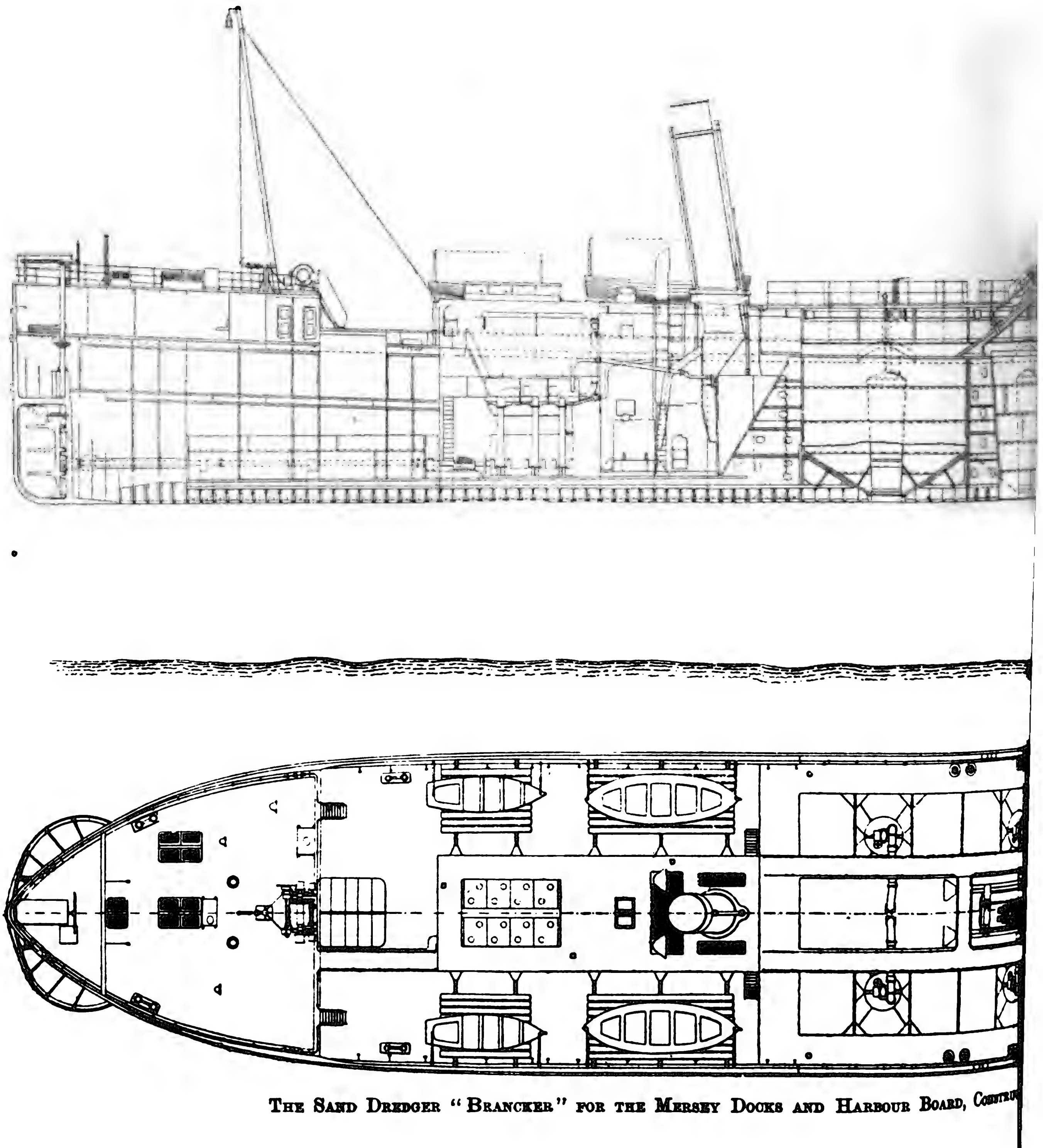
Three new vessels will take the water in November, and one in December. These are the *Forte, Hermione* and *Flora*, cruisers, and the *Dryad*, gunboat. The first keel plate of the *Forte* was laid at Chatham in September, 1891, and the vessel is in a very forward state of preparation. She is to be launched on Dec. 9th, and it is reported that the Duchess of York will on that occasion christen her by the name of *Mayflower*. The *Hermione*, cruiser, will be launched at Devonport on Nov. 7th, and Lady Lyons will perform the christening ceremony. The *Flora* will take the water at Pembroke on Nov. 28th, and the *Dryad* at Chatham on Nov 25th. The engines for the last-named are being fitted by Messrs. Maudslay, and she will be ready for her trials before the end of the year.

The Boilers of the "Sybille."

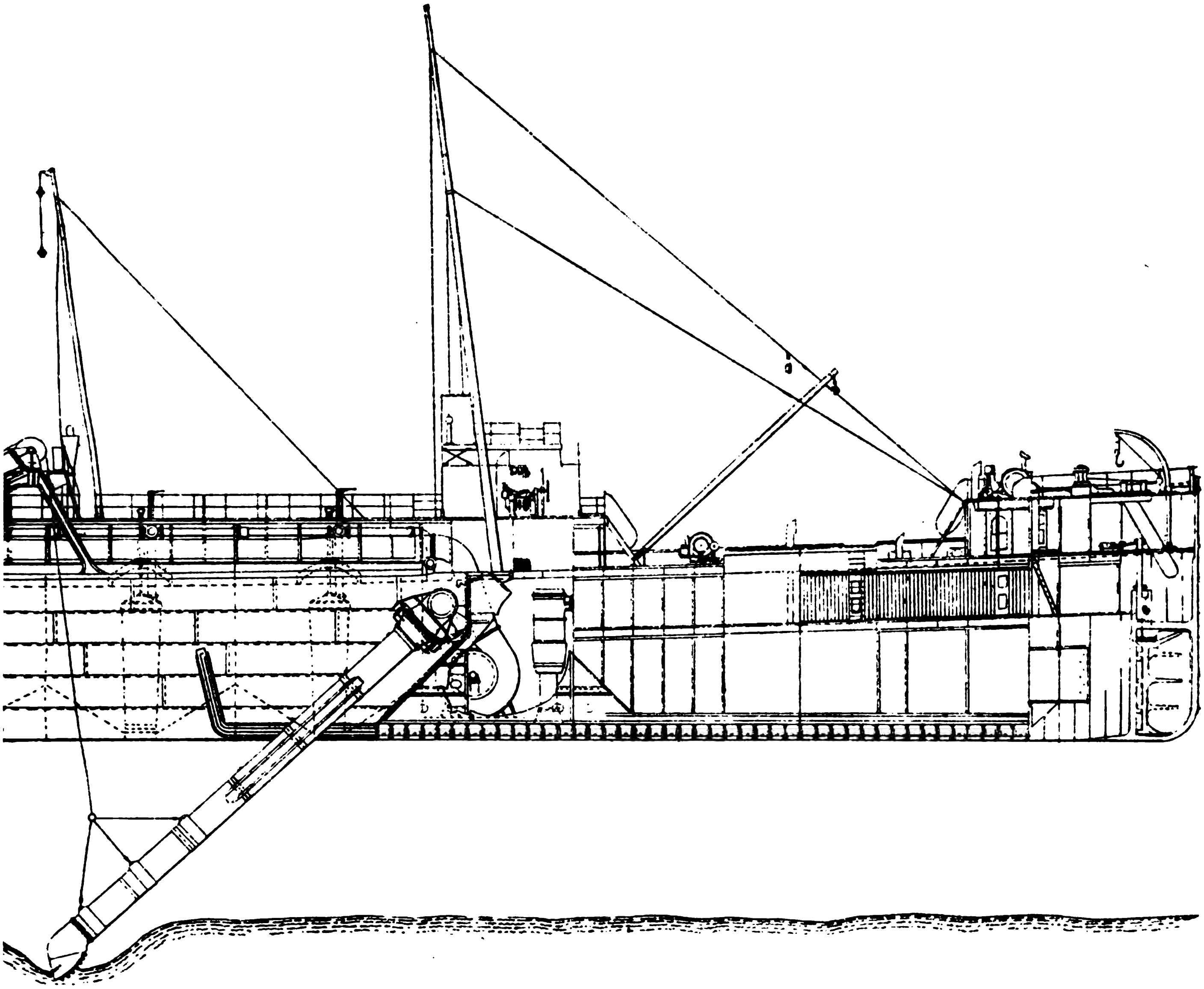
The history of the *Sybille's* furnaces is very unfortunate. This vessel, having been built at Glasgow, was delivered at Devonport Dockyard in the spring of 1892, and, being completed, underwent her trial with fair success. Her furnaces, however, exhibited defects, and it was decided to replace them by others. This was done, and then, under trial, a defect was found in one of the starboard furnaces. The contractors, Messrs. Hawthorne, Leslie, & Co., patched the crack with the permission of the Admiralty officials, but, when tested, another flaw was discovered, this time in a port furnace. On this happening some correspondence took place between the contractors and Whitehall, and, eventually, the following decision was arrived at. Their Lordships stated that they were prepared to accept the boilers of the *Sybille*, subject to the following conditions: "That the whole of the interior work and fittings of the furnaces, combustion chambers, and stay tubes of the port after boiler be renewed; that the defects in the rivetting and jointing of the other boilers be made good; that a satisfactory four hours' trial at natural draught power be made after the above work is completed, and that no defects are discovered on examination after the trial; that the contractors guarantee the efficiency of the combustion chambers, as well as the furnaces, for a period of two years from the date of the first commissioning of the ship." The contractors have accepted these terms, and the defective furnaces are now being removed. It will probably be some time before the ship is ready for sea.

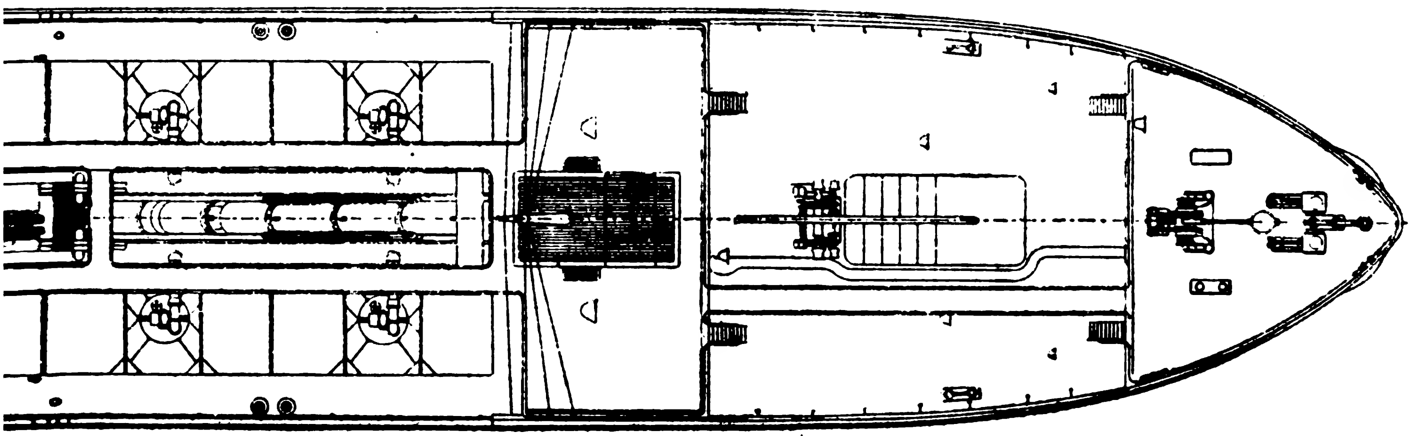
Commissions and Re-Commissions.

The *Ramillies* has been commissioned at Portsmouth as flagship to the Commander-in-Chief in the Mediterranean, and on her arrival at Malta, Admiral Sir Michael Culme-Seymour will hoist his flag on board of her (729). The *Howe* has also hoisted the pennant, but she will remain in the Channel until the *Resolution* is ready to relieve her, when she will also proceed to the Mediterranean. The *Anson* has been recommissioned, and relieves the *Colossus* in the Mediteranean, her place in the Channel being taken by the *Empress*



THE SAND DREDGER "BRANCKER" FOR THE MERSEY DOCKS AND HARBOUR BOARD, CONSTRU





BY THE NAVAL CONSTRUCTION AND ARMAMENTS CO., BARROW-IN-FURNESS (See page 328).

of India. The *Revenge* will relieve the *Rodney* shortly, but, in the meantime, the latter will remain in the Channel. The *Centurion* is to be commissioned to relieve the *Imperieuse* as flagship on the China station, the *Crescent* will take the place of the *Boadicea* as flagship in the East Indies, and the *Bonaventure* will go to Australia as the relief of the *Orlando* now flying the Admiral's flag on that station. It is reported that the *Andromache* and the *Spartan* will be sent as additional ships to the Mediterranean shortly, that squadron being very deficient in scouts. The *Skipjack* and *Gleaner* torpedo gunboats are also named for the same station, one of them as a relief of the *Sandfly*. The *Barracouta* is to commission on November 7th (168), to relieve the *Basilisk*, which has returned home from the south-east coast of America. The *Vulcan* has at last sailed for the Mediterranean to take the place of the *Hecla*. The *Garnet*, on the Pacific station, is to be relieved by the *Calliope*.

The Torpedo-Boat Destroyers.

Contracts have been given out for six more of these small vessels, three to Messrs. Thornycroft, and three to Messrs. Yarrow. Each torpedo-boat destroyer will be supplied with a twelve-pounder quick-firing gun, three six-pounder Hotchkiss guns, a double revolving torpedo tube (mounted amidships), and a bow torpedo tube. The tubes are being made for the use of 18-inch torpedoes, five of which will be allowed to each vessel. Of the six vessels now in course of construction, the *Havock*, *Hornet*, *Daring*, and *Decoy*, are to be completed in the course of a few weeks. The *Lynx* and *Ferret* are to be completed by next April, and the six now given out by the following June. These vessels will cost between £30,000 and £35,000 each. It is considered probable that the remaining eight vessels will be given out to contract before the end of the year. Some trials with the *Havock* have been carried out on the measured mile between Gravesend and Southend. On the first run, with 145 lbs. of steam in the boilers a speed of 24·5 knots was made, with 165 lbs. of steam 26·5 knots was made. This is over the contract speed, since although 27 knots is required of most of these boats 26 knots was considered good enough to try for first. The *Hornet*, by the same builder, is guaranteed to run 27 knots. It is, however, worth noting that French and German builders have already exceeded this speed on trial.

Chatham Dockyard.

There have been several rumours of a reduction at this yard, but they are without foundation, other than that a certain number of extra hands who were taken on, especially and only for the repair of the *Howe*, have now been discharged. These men when they were engaged were given to understand that their services were merely required for a temporary purpose, the work is completed and the men are therefore discharged. There is plenty of work for the ordinary number of men in the yard. The date of the *Howe's* commissioning is Oct. 29th, and she therefore hoists the pennant within less than a twelvemonth of her mishap at Ferrol. The *Minerva*, for which ship a large quantity of material has already turned up, will be laid down in No. 2 dock when the *Dryad* is floated out in November. The drawings for the *Magnificent* have also been received. Ships completing will be the *Agincourt*, *Barfleur*, *Theseus*, *Forte* and *Dryad*. The *Monarch* and *Landrail* have also to be repaired. The *Anson* and the *Immortalite*, of the Channel squadron, have been completed and have sailed. The former goes to the Mediterranean to relieve the *Colossus*. The *Barracouta* and *Skipjack* are being overhauled for commission. The cost of the repair of the *Howe* is £42,000, and the officials of the yard may well feel proud of this creditable feat. The *Forte* will be launched on Dec. 9th, and, it is reported, will be christened the *Mayflower*, by Princess May. The engines of this vessel were made in the yard. Those of the *Dryad* were manufactured by Messrs. Maudslay, and the same firm will, it is reported, provide those of 14,000 H.P. for the *Magnificent*. Messrs. Maudslay have also to provide the *Monarch* with new machinery. During the recent visit of their Lordships, their attention was directed to the need of a new boiler-makers' shop at the yard and to new docking accommodation, a coaling jetty, and a pier for the unloading and shipment of stores, &c.

The Extension of Keyham Dockyard.

The scheme for the extension of Keyham is undergoing revision i[illegible] the new docks may provide adequate accommodation [illegible]se cruisers which the Admiralty have decided to add [illegible] The plans for the docks, basin, and lock will be con[illegible]d, and it is understood that the work will be of [illegible]itude than was at first contemplated. It is impossible as yet to form an accurate estimate of the cost, but at least three millions will be required to complete the work. The closing piers and machinery to be constructed at Keyham at a cost of £85,000 are not to be commenced until the dockyard scheme has been finally settled. The work will be undertaken in sections, each of which will be completed before a fresh one is commenced. The great difficulty appears to be which section to start with first, the dock, basin, or lock, but as a lock is most suitable for general purposes, and, on an emergency, could be put to the same practical use as a dock, it is not unlikely that the lock will be first constructed. The dimensions of the docks, which were to have been one of 600 feet in length and two of 500 feet, are likely to be increased to one of 700 feet, another 600 feet, and the third about 550. If a sufficient sum is allowed in next year's estimates, the preliminary arrangements, such as boring work, and the construction of a dam around the extension ground, could be completed by the middle of the financial year. To carry out the extension in its entirety with ordinary labour will take about eight years. The employment of convicts for excavating work is not likely to be approved of, as there is good reason to believe from the results at Portsmouth, that if they were engaged the period for completing the work would be increased by at least two years.

Devonport and Keyham Yards.

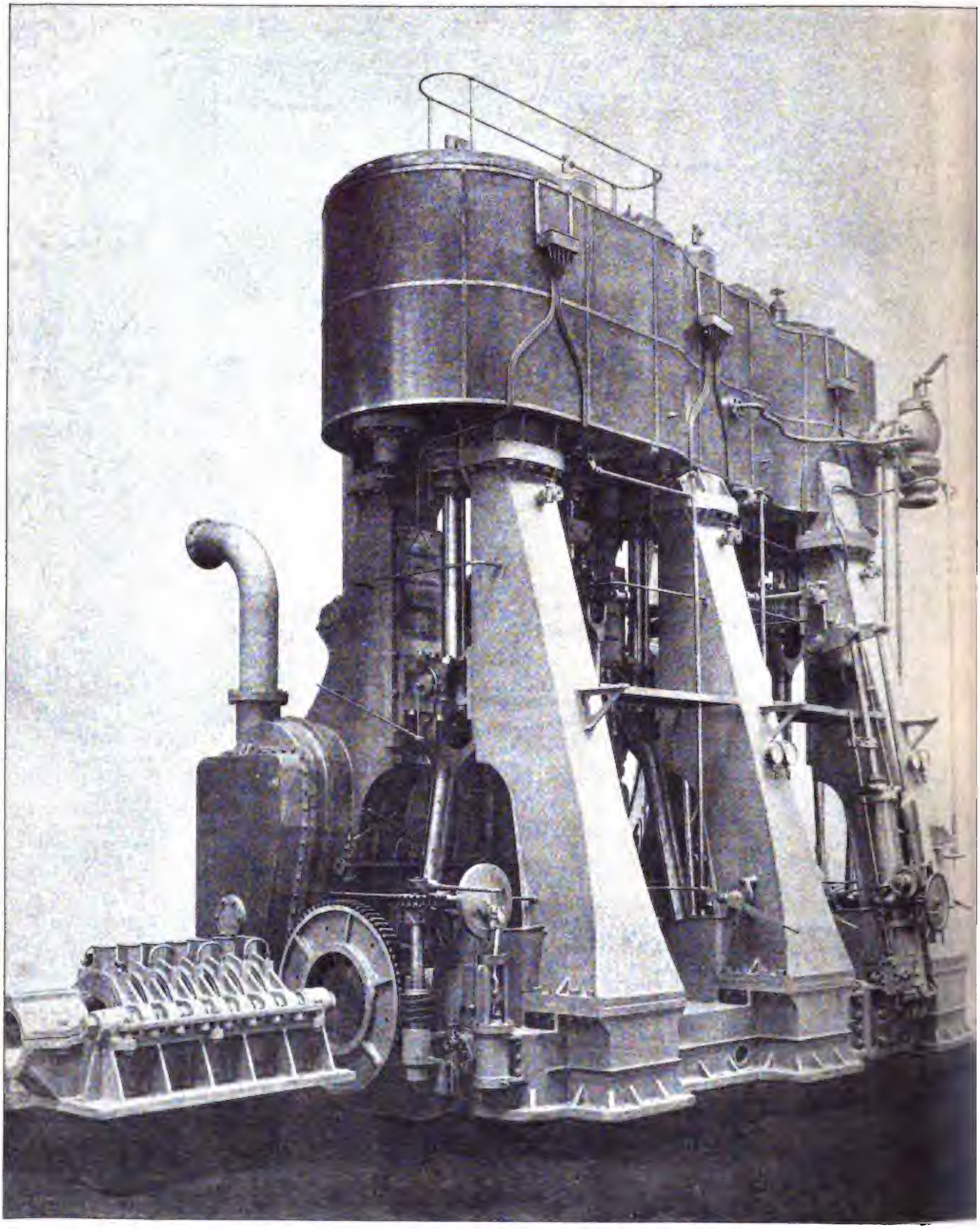
The Channel fleet ships, *Narcissus*, *Bellona*, and *Speedwell* have been completed for sea and left, these three vessels having given employment to a number of men in the constructive and engineering departments. However, there is no lack of work at this yard, and no apprehension is felt that there will be any discharges. The *Warspite* is having new evaporators fitted on board, and the *Undaunted* is also being prepared for a further period of sea service. The refit of the *Phæton* will cost £13,000, the *Northumberland* is also in course of refit and the *Astræa* wants a good deal doing to her before she is ready for sea. The *Forth* is nearly finished, the *Sybille* is still in the contractor's hands, and the gunboats *Spanker* and *Sharpshooter* also give employment. The *Hermione* will be launched November 9th. She has been sheathed on the job-and-task system in the short space of twelve weeks. The results of the new system on this vessel, and her sisters the *Fox* and *Charybdis*, are so satisfactory that it will in all probability be adhered to in future. It has been decided to spend £15,000 in dredging the Sound, and a Thames firm, the London and Tilbury Lighterage Co. have been engaged to carry out the work. Their steam dredger has arrived at the dockyard, and the business will occupy some months. The *Spider* gunboat, which has been engaged in the instruction of engineer students during the summer, has now been placed out of commission. The instruction has been of such practical benefit to the students, that, during the winter they will take the machinery to pieces and execute necessary repairs, she is to be re-commissioned next spring for the same purpose.

New Complements for Men-of-War.

In accordance with the recommendations of a committee which has been investigating the subject, the Admiralty have revised the seagoing complements of a large number of vessels. Alterations have now been made in the executive, artisan, medical, accountant, and marine branches; those in the engineering department having already been notified. The vessels now in commission which will be affected by the revision are the *Active*, *Alacrity*, *Alecto*, *Alexandra*, *Amphion*, *Archer*, *Beagle*, *Blake*, *Blanche*, *Blonde*, *Boadicea*, *Boomerang*, *Bramble*, *Brisk*, *Buzzard*, *Cockatrice*, *Collingwood*, *Cossack*, *Daphne*, *Dreadnought*, *Edinburgh*, *Fearless*, *Firefly*, *Firm*, *Garnet*, *Gannet*, *Hearty*, *Immortalité*, *Jackal*, *Katoomba*, *Landrail*, *Leander*, *Linnet*, *Lizard*, *Marathon*, *Melita*, *Melpomene*, *Mildura*, *Minotaur*, *Mistletoe*, *Mohawk*, *Narcissus*, *Neptune*, *Nile*, *Nymphe*, *Orlando*, *Pallas*, *Penelope*, *Philomel*, *Phœbe*, *Porpoise*, *Racer*, *Racoon*, *Raleigh*, *Rattler*, *Ringarooma*, *Rodney*, *Ruby*, *Sandfly*, *Sans Pareil*, *Scout*, *Severn*, *Sphinx*, *Superb*, *Surprise*, *Swift*, *Swiftsure*, *Tartar*, *Tauranga*, *Tourmaline*, *Volage*, *Watchful*, and *Wrangler*. In those vessels already in commission the change will not take place until after paying off, but the revised complements will have to be supplied to all vessels hoisting the pennant after October, 1893.

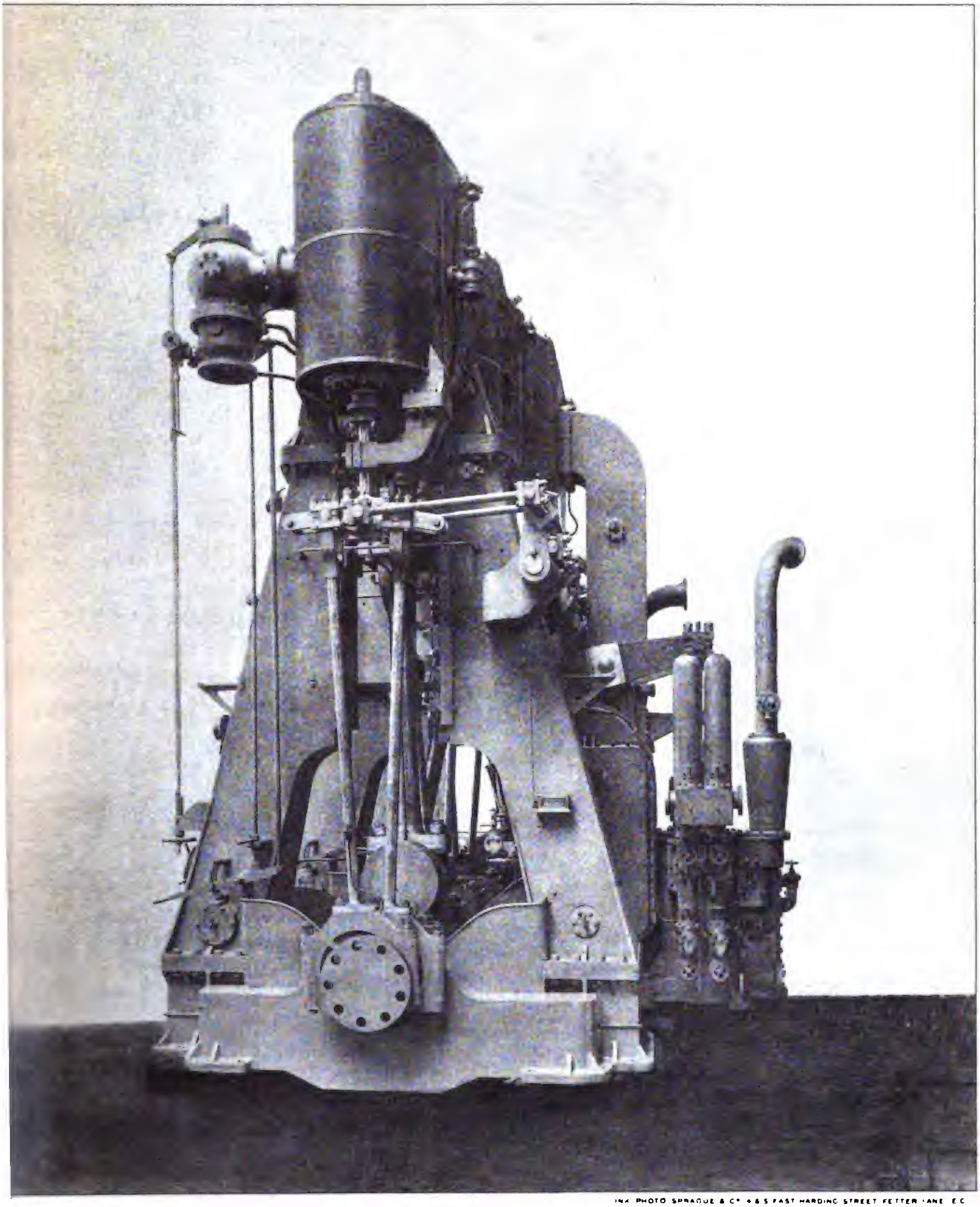
The New Cruisers.

The cruisers *Talbot*, *Minerva*, and *Eclipse*, which, in the case of the two last mentioned, are to be commenced this month at Chatham and Portsmouth, respectively, are to be constructed and fitted out as flagships. Although 30 ft. longer and with 3 ft. 6 in. more beam than the *Astræa* class, they will be of similar design. Their armament will be much more powerful, five 6-in. and six 4·7-in. guns being provided for instead of two 6-in. and eight 4·7-in., as



TRIPLE-EXPANSION MARINE E

Constructed by Messrs D



ines of the S.S. "CATALINA."

& Jackson, Govan, Glasgow.

the *Astrea* class. The amount to be spent on the three vessels this year is:—*Talbot*, £24,781; *Minerva*, £28,168; *Eclipse*, £16,734. The *Talbot* is to be built at Devonport on the slip from which the *Edgar* was launched, but as this slip is now occupied by the *Harrier* gunboat, the cruiser is not likely to have her keel laid until January next. The second high-pressure cylinder for the engines of the *Minerva* has been cast in the foundry at Chatham. The weight of the metal used was 20 tons, and the operation was entirely successful. The couplings for the main shafting of the engines of the *Talbot* are being manufactured at Keyham, the cylinder liners and several portions of the machinery have already been cast, and the moulds for casting the cylinders are being prepared.

Pembroke Dockyard.

The machinery for the *Hazard*, gunboat, has arrived from the Fairfield Co.'s yard at Glasgow. The *Cambrian* has been docked after her trials, and is to be fitted for sea in all respects with the exception of the provision of her sea stores, which she will not take on board until she is sent to Devonport for commissioning. In order to make room for the *Flora* she is to be completed with dispatch. The *Renown* is growing apace, the bottom is now plated, and her bronze stem and sternpost are in place. The armour will be supplied by the firms of Messrs. Cammel & Co. and Messrs. Vickers & Co., and will be Harveyed on the new principle, which has proved to be a great success at recent trials. There is no apprehension at this yard that any discharges will take place, as the work in hand and projected is amply sufficient to give employment to the men at present on the establishment. The *Rupert* has been out for target practice, and has returned to her moorings opposite Commercial Row. The *Flora* will be launched in November, and then the *Renown* will be the only ship on the stocks.

Royal Naval Reserve Firemen.

New regulations, having reference to the enrolment of stokers in the Royal Naval Reserve, have been issued from the Admiralty. Every applicant in the new corps must be between 21 and 35 years of age, and must prove two years' service at sea, at least one year of which as "fireman and trimmer," "fireman," or in a higher stokehold or engine-room capacity. The discharges must show "very good" character for ability and conduct, and the applicant must declare that it is his intention to follow the sea service for at least five years from the time of his engagement. Medical examinations will take place by the nearest naval medical officers. Firemen of the old force will be allowed to enrol under the new system provided they are eligible, and make application within six months of their return to the United Kingdom after the issue of these rules. The period they were in the old force will count for pension. Every fireman entered under these regulations will be required to drill for 21 days continuously in the first year of entry, or be allowed to divide the 21 days into two periods, and to take for the first period not less than 14 days' drill without a break, and for the second period not less than seven days' drill. In subsequent years 14 days' drill will be required, or if the exigencies of the service permit two periods of not less than seven days each. While on drill firemen will be paid 1s. 9d. a day, and will also receive 4d. a day lodging allowance, and 1s. 4d. a day subsistence allowance. A suit of clothes will be issued to each man on enrolment for a period of five years. Each fireman, as long as he remains in the Reserve and abides by the conditions of his engagement, will be entitled to an annual payment of £6 in four quarterly instalments of 30s. each. No payment will be made to any fireman without statement by the naval officer on his certificate that he has gone through the periods of drill necessary. Every member of the new corps of firemen will be required to actually serve at sea as fireman and trimmer, fireman, or in a higher stokehold or engine-room capacity during the first and second periods of his service in the R.N. Reserve, but for any subsequent period of enrolment he may work either at sea or on land, provided he has not abandoned the calling of fireman. Failure to comply with the above conditions as to sea service will entail suspension of drill and retainer. No person will be eligible for re-enrolment after the age of 45. Firemen entered under these regulations will be entitled to the same pensions as first-class Royal Naval Reserve men.

Sheerness Dockyard.

The Lords of the Admiralty did not spend more than five or six hours over the inspection of this yard, but that was sufficient to show them that the grass is not allowed to grow under the feet of those in the establishment. The *Speedy*, of course, occupied their attention, and there is some hope that they have considered the projects for forming torpedo boat, and coaling stations at this port. The extension of No. 3 dock, which has often been mooted, is still in abeyance, and there is no expectation that the repairs of the *Comus* will be taken in hand until those of the *Rambler* are completed. The *Landrail* is to have her tubes ferruled. The *Basilisk* has arrived, but she will pay off at Chatham, when the *Barracouta* is to be commissioned to take her place on the South East Coast of America station. The ships which are now completing, are the *Charybdis* cruiser, and the gunboats *Leda*, *Alarm*, *Hebe*, *Renard*, *Onyx*, and *Speedy*.

Ferruled Boiler Tubes.

A correspondent on board H.M.S. *Barham*, writes:—"The Admiralty ferrule is not an unmixed blessing to the engineers of this ship, and they give immense trouble. After several hours steaming the ferrules get choak a block with dirt, which is most difficult to remove. It is found that sweeping tubes are not effective, as the brush pushes the ferrules out of the tubes, and if the steam jet is used, the condensed steam makes matters worse, so that the process of cleaning tubes properly at sea in a ship of this type, fitted with the patent ferrules, is a tedious one, special appliances having to be used." It was suggested that, by altering the furnace bridge, so as to deflect the flame, the choking of the tubes might be, to a great extent, if not entirely overcome. To give the suggestion a trial, steam was raised in two boilers of the *Bellona*, one of which had been altered as proposed, and the other left as before. The steaming was to be at three-fifths power for twelve hours. Before steam had been up eight hours, it was found necessary to draw fires, as unmistakable signs of choking were observed. The results of the experiment showed the ferrules to be in a very bad condition—some completely, and the remainder partially choked. Although the furnace bridge was altered in such a manner, that the flames were deflected from the tube ends, the additional draught and heat necessary to get the required steam pressure was more than sufficient to counteract any benefit derived from the slight deflection of the flames. The trial demonstrated that the *Bellona* is unable to steam at full speed for more than six hours, as at the expiration of that time the whole of her tubes would be choked. The efficiency of the ferrule for tubes of small diameter is also called in question by the results of this trial.

Malta Dockyard.

A correspondent writes to me from Malta, that the *Polyphemus* has arrived, and having made her paying off trial, has been taken into dock for a thorough refit. The *Imogene* has arrived from Constantinople, also to pay off and refit. Both these vessels will recommission here with crews from England. The *Colossus* and *Edinburgh* have come in for the purpose of exchanging their forty-three ton guns. Three from the *Colossus* will be placed on board the *Edinburgh*, in exchange for three of hers, which have been reported defective. Mr. Robertson, the Civil head of the Admiralty, has been here on a visit of inspection and takes great interest in anything that is shown to him. With regard to the mishap to the *Camperdown*, a court of inquiry has decided that the officers of the ship are not to blame, the accident being due to a defection in the steering machinery, which caused the wheel to jamb. Subsequent examination of the vessel revealed that although she had taken the ground slightly, the hull had sustained no injury, and it was not necessary to dock her. The repairs to the machinery of the *Polyphemus* will include new tube plates to the condensers, the boilers are also to be retubed, and the tubes ferruled. The *Ramillies*, *Anson*, *Howe* and *Rodney* are expected to arrive here before the end of the year, the *Colossus*, *Inflexible* and *Edinburgh* returning home on their arrival.

The Sturtevant Blower Co.—This company are about to change their title owing to the rapid increase in their engineering and contracting department to the more comprehensive title of the "Sturtevant Engineering Co.," as it better describes the nature of their business. The management and interests will remain the same as heretofore. The change will take place on Nov. 1st.

The Majestic.—Drawings of the *Majestic*, the new first-class battleship which is to be laid down at Portsmouth, were received at the dockyard on October 23rd. Her length will be 390 ft., extreme breadth 75 ft., mean draught 27½ ft., and displacement 14,900 tons. While, therefore, the new armourclad will be 10 ft. longer and 750 tons heavier than the ships of the *Royal Sovereign* class, she will have the same breadth and draught.

INSTITUTE OF MARINE ENGINEERS.

THE TESTING OF BOILERS.

A MEETING of the Institute of Marine Engineers was held on September 25th at the Institute premises, 58, Romford Road, Stratford, when the subject of discussion was the paper by Mr. J. F. Livesey, read at the previous meeting on "The Testing of Boilers." This paper was published in our last number. Mr. F. W. Wymer presided, and there was a large attendance.

The Chairman, in opening the proceedings, remarked upon the comprehensive character of Mr. Livesey's paper, which, he said, embraced several points that were quite beyond the question of boiler testing, and invited members to continue the discussion commenced a fortnight ago.

The Honorary Secretary (Mr. J. Adamson) first read a communication that had been received from Mr. G. W. Buckwell, of Liverpool, who wrote: "The author of the paper on 'The Testing of Boilers' refers to the method of testing boilers at the Great Northern Railway Works as a sample of the way locomotive boilers are treated. When employed at the Brighton Railway Works in 1882, the method I saw adopted by the late Mr. Stroudley was as follows:—The boiler was filled with water, and the fire lighted; when the gauge showed 30 lbs. the fire was put out. Water was then pumped in till the gauge showed 240 lbs.; then it was lowered to the usual water-line, and steam raised till the safety valves blew at the working pressure of 140 lbs. The boiler was thus allowed to expand somewhat before the hydraulic test, so as to bring it nearer working conditions. The whole operation of heating the boiler, subjecting it to the hydraulic test, and then raising steam to float the valves was a continuous one. I think it appears reasonable that the hydraulic test should be performed with hot water in preference to cold, so as to assimilate to working conditions, but to dispense with the hydraulic test altogether, and to use a steam test in preference, is a bold operation, which marine engineers are hardly likely to imitate. The pressure to which a test should be carried should depend, I think, on the limit of elasticity of the metal, rather than on the mere working pressure of the boiler or ultimate strength of the material, but there is no doubt that the present methods of dealing with the subject are well on the safe side."

Mr. A. W. Anderson said that as boilers were made at the present day he did not think they should have much trouble with them if they were properly taken care of, especially in getting up steam. Let it be done carefully. He had seen a number of boilers worked at 180 lbs. pressure, and having examined them carefully he could not find much the matter with them except bad workmanship. He had also had a good deal to do with these boilers afterwards in having them repaired, and he found the rivet holes bad—not fair. He had to cut out the rivets, broach the holes and put new ones in, and even then he could not make the best of jobs, because the saddle plates had never been home to their work—never properly fitted. In trying to get them up to their work the makers had used a fullering iron. It was no good putting new rivets into the old holes; they would not have been of any use. There was a great deal said in the course of the paper about caulking the seams with water in the boiler and steam up, but he never knew good caulking to be done under such conditions. In caulking with water in a boiler they had a springy substance to deal with at the point of the leak, and the water was forced up by the blow, but it immediately came back again. He had often seen an attempt made to stop a leaky tube at the back end while the water was in the boiler, but it could not be done. The construction of boilers at the present day, so far as their design was concerned, was very good, but a great deal more attention should be paid to the workmanship. He had also cut strips from the material of the boilers, and, having tested them, had found them very good. The question had been asked, why a leak could not be caulked tight while water was in the boiler? His answer was that, water being in the boiler, the two parts could not be made dry either by the use of an expander or caulking iron and hammer, and in consequence there would always be a film of water between the parts which required tightening.

Mr. P. Scarth said he believed it was a common practice to caulk the seams of a boiler with the water in it. He had seen it done frequently, and the seams made tight; in fact, he thought it was the usual practice. Of course the seams were all caulked before the water was put in, but all leakages were made good with the water in, the usual method being to reduce the pressure, and then caulk. The reason why caulking under pressure caused leakages at other seams was that the jarring caused by the blow would be communicated to the other parts of the boiler. He knew of a case in which this was mentioned in a Board of Trade inquiry, where some men were caulking a boiler under steam, when it exploded, killing the men. With regard to the hydraulic test, he could not advocate testing to double the working pressure. It was very well where they knew the materials and the manner of construction, but in boilers about 15 or 20 years old, when they did not know whether holes had been punched or drilled, or the quality of the metal used, or how much of its elasticity it had retained, there was a possibility of overstraining the boiler. He would again quote two cases, where boiler explosions occurred after overtesting. In both cases the hydraulic tests were undertaken by men ignorant how to proceed. In one case the man pumped the boiler up to 165 lbs. per square inch, and reckoned the working pressure should be 60 lbs. Nevertheless this boiler exploded a few months afterwards, and the application of this test had only aggravated the defects that were already in the boiler. In the second case the pressure was 60 lbs. for 30 lbs. working pressure, and the boiler exploded a fortnight afterwards at 30 lbs. Of course these tests were made by unskilled persons, but still they showed that the hydraulic test was not a sure indication of strength. An arrangement of gauges by which the amount of hogging of furnace tubes and movements of combustion chambers, under steam pressure, could be frequently ascertained would supply some very useful information as to the stresses the boiler was subject to under working conditions, and also if any permanent set took place. To quote Wilson, "a boiler could be made to stand 200 lbs. or 300 lbs. water pressure and yet explode at 30 lbs. steam." Many boilers, in order to stand the high-water pressure demanded for a hydraulic test, and to be rigid, were overstayed and too rigid, and he had frequently observed new boilers of the Lancashire type for high pressures leaking about the fronts, under steam, which had been quite tight under water pressure at over double the steam pressure. In testing a furnace flue about 23 ft. long, it commenced moving at 30 lbs. and had gone 3-16th of an inch at 70 lbs. when the test was stopped. He thought that the highest pressure allowed on such a tube should not be more than where the first movement commenced.

(To be continued.)

Steel in Shipbuilding.—The opening meeting of the session of the West of Scotland Iron and Steel Institute was held on October 13th in the Andersonian Building, West George Street, Glasgow. Mr. Riley, the President, occupied the chair, and delivered a brief introductory address, in the course of which he said that the opportunities in the present day for the use of steel of a different character from that which for a few years they had been accustomed to produce were becoming very great, and he felt that it only required a lead, such as was given at the time mild steel was introduced, to enable engineers and shipbuilders to make a new departure in order to raise up another branch of business. He might give an illustration of what he meant. Two very large ships had recently been built on the Clyde. It was known that considerable difficulties arose, and there was serious dissatisfaction in certain respects. He had no doubt in his own mind that if a different material had been used in the construction of these vessels these difficulties would not have appeared. If, instead of using a material which gave an ultimate breaking strength of, say 20 tons per square inch, they had taken advantage of another kind of steel which was known to them, which would have given a breaking strength of 40 tons per square inch, the rigidity of these vessels would have been very different from what it was. He was sure that if another such propaganda took place there was sufficient enterprise among shipbuilders to seize upon the product, especially for these great vessels. Time and energy were required for such a propaganda, and those who had fought through the mild steel question would feel no hesitation about entering on a similar enterprise.—Mr. J. B. Allan afterwards read a paper on "The Theory of Stresses in Mild Steel Shafting."

Hamburg.—The number of ships which entered and cleared at the port of Hamburg in the first eight months of this year was 12,011, of an aggregate burden of 7,925,771 tons. The corresponding number of entrances and clearances in the corresponding period of 1882 was 12,030, of an aggregate burden of 7,823,243 tons; and in the corresponding period of 1891, 11,418, of an aggregate burden of 7,409,568 tons.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from September 26th, 1893, to October 25th, 1893 :—

Andrew, W. J., chief engineer, has been advanced to the rank of staff engineer in Her Majesty's fleet.

Baldwin, H. C. St. C., engineer to the *Howe* to date October 31st.

Banister, C., engineer to the *Ramillies*, to date October 17th.

Bell, E. (temporary service engineer, with seniority of June 11th, 1884), to be engineer in Her Majesty's fleet, from July 29th, 1893.

Bennett, David J., chief engineer to the *Vivid*, to date October 5th.

Black, W. J., engineer to the *Alberta*, to date October 20th.

Bluett, Peter W. P. (probationary), assistant engineer to the *Immortalité*, to date October 19th.

Brown J. (temporary service engineer, with seniority of May 22nd, 1884), to be engineer in Her Majesty's fleet from July 29th, 1893.

Brown, Thos. F. (probationary), assistant engineer to the *Centurion*, to date October 14th.

Brown, W. F., staff engineer, has been advanced to the rank of fleet engineer in Her Majesty's fleet.

Bryer, Sydney M. G. (probationary), assistant engineer to the *Howe*, to date October 31st.

Burner, A., assistant engineer to the *Ramillies*, to date October 27th.

Chisman, E., assistant engineer to the *Ramillies*, to date October 27th.

Coad, H. S., engineer to the *Hornet*, to date October 24th.

Cook, J. A. (temporary service engineer, with seniority of December 16th, 1885), to be engineer in Her Majesty's fleet from July 29th, 1893.

Denny, J. T. H., staff engineer, has been advanced to the rank of fleet engineer in Her Majesty's fleet.

Ellis, E. H., assistant engineer, has been promoted to the rank of engineer in Her Majesty's fleet.

Figgins, John W. (probationary), assistant engineer to the *Vulcan*, to date October 16th.

Garwood, Harry T., engineer to the *Audacious*, to date October 13th.

Gibbs, A. W., engineer, has been promoted to the rank of chief engineer in Her Majesty's fleet.

Guyer, Frank (probationary), assistant engineer to the *Howe*, to date October 31st.

Haggarty, Chas. A., engineer to the *Howe*, to date October 31st.

Hall W. (temporary service engineer, with seniority of May 22nd, 1884), to be engineer in her Majesty's fleet from July 29th, 1893.

Harding R., chief engineer, has been advanced to the rank of staff engineer in her Majesty's fleet.

Hines, W., chief engineer, has been advanced to the rank of staff engineer in Her Majesty's fleet.

Huddy, T. B., engineer to the *Barracouta*, to date October 20th.

Kerr, Alex., chief engineer to the *Barracouta*, to date October 7th.

Kimber, John L. (probationary), assistant engineer to the *Centurion*, to date October 14th.

Kingston, F. J. (temporary service engineer, with seniority of May 22nd, 1884), to be engineer in her Majesty's fleet from July 29th, 1893.

Lane, Chas., staff engineer to the *Rodney*, to date October 5th.

Lemon, John A., fleet engineer to the *Conqueror*, to date October 5th.

Little H. J., assistant engineer, promoted to the rank of engineer in Her Majesty's fleet.

Liversedge, H. T. (temporary service engineer, with seniority of April 8th, 1886), to be engineer in her Majesty's fleet from July 29th, 1893.

Lonnon, W., chief engineer, has been advanced to the rank of staff engineer in Her Majesty's fleet.

Madge, H A. (temporary service engineer, with seniority of February 1st, 1887), to be engineer in Her Majesty's fleet from July 29th, 1893.

M'Laurin, J., assistant engineer to the *Ramillies*, to date October 27th.

Markham, R. C. L. (prabationary), assistant engineer to the *Ramillies*. to date October 17th.

Nicholson, J. D., staff engineer, has been advanced to the rank of fleet engineer in Her Majesty's fleet.

Norris, C. McKenzie (temporary service engineer, with seniority of May 13th, 1886), to be engineer in Her Majesty's fleet from July 29th, 1893.

North, C. J., staff engineer to the *Ramillies*, to date October 17th.

Paterson, James A. (probationary), assistant engineer to the *Cossack*, to date October 20th.

Ramsay, T. W. B., fleet engineer, has been promoted to the rank of inspector of machinery in Her Majesty's fleet.

Rayner, A., chief engineer, has been advanced to the rank of staff engineer in Her Majesty's fleet.

Reynolds, J. A. (temporary service engineer, with seniority of October 8th, 1887), to be engineer in Her Majesty's fleet from July 29th, 1893.

Roffey, Jas. R., engineer to the *Barfleur*, to date October 7th.

Shattock, Thos. (probationary), assistant engineer to the *Rodney*.

Stewart, Chas. E., fleet engineer to the *Howe*, to date October 31st.

Stewart, Thomas (probationary), assistant engineer to the *Rodney*, to date October 23rd.

Swift, L. W. (probationary), assistant engineer to the *Ramillies* to date October 17th.

Wall, Henry M. (probationary), assistant engineer to the *Retribution*, to date October 14th.

Weeks, J. C., inspector of machinery has been promoted to the rank of chief inspector of machinery in Her Majesty's fleet.

Wise, F. (temporary service engineer, with seniority of May 28th, 1886), to be engineer in Her Majesty's fleet from July 29th, 1893.

HOAR & BROWN'S HARDWOOD MARKET REPORT, OCTOBER 23rd, 1893.

TEAK—	TIMBER. *Loads.*	PLANKS. *Loads.*	BLOCKS. *Loads.*	TOTAL. *Loads.*
Stock, 1st Oct., 1893	6,031	2,644	26	8,701
Landings	100	49	Nil	149
	6,131	2,693	26	8,850
Deliveries	634	128	Nil	762
Stock, 21st Oct., 1893	5,497	2,565	26	8,088

A strengthening feature this month is the requisition from H.M. Admiralty for 8,900 loads of logs, to be taken either from floating or landed stocks. This large enquiry has already had the effect of hardening prices, and all low quotations for floating cargoes have been withdrawn for the present. The deliveries for the month are fairly large, and stocks have slightly decreased, sales are becoming more frequent, and all round a better feeling is noticeable; but still spot prices are very low indeed, and likely to remain so, considering the accumulation of timber in every teak port in the United Kingdom.

Planks are still dull of sale, and stocks ample, but showing 100 loads less in quantity since last report.

MAHOGANY.—At the last public sale an eagerness was displayed to buy anything sizeable, extravagant prices however were not paid.

Large logs are still in demand at moderate prices, and an advance is not at the present looked for. The panel contractors have plenty of timber for present use and will not stock further at advanced figures. Inferior qualities are selling at much reduced values, there being very little inducement for dealers to take up parcels of this character. Cuba is being importedvery freely, and prices are upon the decline for small wood, but anything 14 in. and up, straight and sound, is fetching the usual figure. Importers ideas are far beyond the market values.

There has been no further sale of Mexican, which remains at the same low quotations as mentioned in our last.

CEDAR.—Stocks in dealers hands are still small. There is a very straight and sound parcel just arrived, which it is expected will be realized very profitably.

KAWRIE PINE.—Sales are being frequently made at prices enabling importations to be carried on at a profit to the shipper.

SEQUOIA.—Quotations are extremely low, and a further consignment has been placed upon the market, making it still more difficult to obtain fair prices.

PADOUK.—A steady demand continues. There is only one parcel here and sales appear to be frequent at fair market values.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND

(From our own Correspondent.)

THE shipbuilding and engineering trades in the above districts are very much in the same state as when we issued our last report, and very few new orders have been booked during the past month. Still, the amount of work on hand at present is sufficient to keep a considerable number of men employed till the end of the year, even should no further orders be booked. As we hinted in our last, the dispute between the shipbuilders and their carpenters and joiners was only settled in a temporary manner, and as the men had no definite proposals to bring forward when asked, a general lock-out has been resorted to, and this threatens to be a very serious dispute. The masters have been so badgered about by the aforesaid workmen, that they are readily excused if their action has been a little hurried, and when the low prices obtainable for work is considered, it is evident that if the masters say they will close their yards, there is every possibility that they will do so. Strikes are like any other misfortune, they never come singly, the new body who have caught the spirit of the day, being the frame-setters, their bane of contention apparently being that the rules in the various yards allow the earning of more money in one instance than in the other. We have not space here to enter into this matter, but when we learn that the average earnings of the frame-setter, after deducting payments to helpers and boys is 2s. 4½d. per hour, an outsider will be inclined to doubt the statement that these well-paid men can quarrel over such a trifle as the present dispute.

Leaving strikes for this month, we are pleased to intimate the following new orders as having been booked since last writing. The London and Glasgow Shipbuilding and Engineering Co. has booked a steamer of 3,600 tons capacity for the Glen Line, engines to be supplied by builders. Messrs. Barclay, Curle & Co. have booked a tug of the following dimensions for the Admiralty: Length, 144 ft., by 27 ft. 3 in. beam, by 15 ft. 9 in. deep, with a displacement of 680 tons. She will be provided by the builders with twin-screw engines to indicate 1,250 H.P. combined, and will be one of the most powerful tugs afloat. At the end of last month, Messrs. Simons & Co., Renfrew, booked an order to build two large dredgers for Russia. The Campbelltown Shipbuilding Co., early this month, placed the contracts with Messrs. Rankin & Blackmore, Greenock, and Messrs. Kincaid & Co., Limited, Greenock, for two sets of triple-expansion engines of 1,100 and 800 H.P. respectively. These engines are for steamers which they are at present constructing in their yard at Campbelltown. Messrs. Cumming & Ellis, Inverkiething, have contracted to build a steamer of 750 tons gross for Messrs. G. & J. Denham, Greenock, to replace the s.s. *Carron Park*, which will be taken over by the builders. Messrs. Ramage & Ferguson, Limited, Leith, have booked orders for a 1,200 ton cargo steamer for Mr. Thos. Cowan, Grangemouth, and also a yacht for an English owner. Whilst on the east coast we may mention that Messrs. John Scott & Co., engineers and shipbuilders, Kinghorn, after having made extensions and alterations to their yard, as described by us some months ago, have had their name enrolled on the Admiralty list, and may now be called upon to tender for the construction of ships of all classes, with propelling machinery and boilers.

In a journal like ours, so directly connected with the sea, we may be excused mentioning that on the 30th September a very successful demonstration in the shape of what is now known generally as "Lifeboat Saturday," took place, the object being to raise sufficient funds to build a steam lifeboat, to be called the *City of Glasgow*. The demonstration took the shape of a procession and aquatic sports, and a sum slightly in excess of that required for the boat was raised. In a town like Glasgow, which practically lives by those on the sea, the result was a foregone conclusion, and it is to be hoped that subscriptions to the National Lifeboat Institution will be forthcoming in the future without the aid of an optical demonstration of the brave work done by its employés.

The prolonged struggle in the coal trade in the South has been decidedly beneficial to the masters and men here, and also to all those indirectly interested. Prices have advanced, and local collieries have, in most instances, had difficulty in coping with the demand. At Greenock, during the past four weeks, quite a boom in coal shipments has been experienced, no fewer than 58 vessels, principally steamers of a handy size, have taken in coal cargoes here. At Leith steamers have been arriving daily for supplies, and the various coal tips at the docks have been exceedingly busy. The total quantity of coal shipped at Leith during the first week in August was 18,133 tons, a shipment almost unprecedented in the history of the docks, and certainly during the past few years. Business in Firth of Forth chartering is brisk, and freights, after advancing considerably, remain firm.

At a meeting of the Burntisland Harbour Commissioners on the 17th, it was agreed that a conference be arranged for, between representatives of the North British Railway directors and the Burntisland Town Council, with a view to arranging terms upon which the construction of new dock works could be proceeded with. The contractors have now commenced operations in connection with the new deep dock at Leith, and at a meeting of Leith Dock Commissioners, on October 13th, the superintendent reported that a commencement had been made with the embankment. The excavations of the trenches for the side wall of a new graving dock, close to the Prince of Wales Graving Dock, are also being proceeded with.

In the beginning of the month the iron ship *Martin Scott*, 1,388 tons register, built in Greenock in 1875, and owned by Mr. C. S. Laird, Greenock, was sold to Messrs. Bordes & Sons, Bordeaux.

There is every prospect of the project known as the Proposed Forth and Clyde Ship Canal being again brought to the fore. We have all along been in favour of this waterway as a commercial enterprise, placing the two coasts of Great Britain in direct and safe communication as well as supplementing the English Channel as a course for continental steamers to America, and we hope in our next Notes to give some particulars of the work of the promoters since we last turned to this subject.

TRADE NOTES FROM THE TYNE, WEAR, TEES, HARTLEPOOLS, &c.

(From our own Correspondent.)

THE TYNE.

Shipbuilding.—There is no doubt that at the present moment the shipbuilding industry is under a cloud, and in this district, at all events, it is consistent with the truth to say that no orders of importance have been booked within the month. It is commonly believed that the great coal strike in the Midlands is partly responsible for the present deadlock in trade, and if this theory is correct, it is reasonable to look for an early improvement, as the calamitous struggle referred to is evidently nearing its close. The statement has again been revived, and has even formed a leading item of intelligence in the October monthly report of a leading trade society, that Messrs. Armstrong, Mitchell & Co. had received from the Admiralty an order for a large battleship. On enquiry we find that there is not a vestige of foundation for the statement, and it seems clear that such an order cannot reach this firm or any other until something in the way of a new naval programme is submitted to and adopted by Parliament. It is probable that an order for a large cruiser, or a battleship, may soon be received from the Japanese Government, but nothing can be said with regard to this matter at present, as nothing has been definitely settled. At the Low Walker yard belonging to the firm there are now only two vessels on the stocks, and these are nearly completed. It is understood, however, that the firm has got an order for three small steamers of a special type, and the work of building these will keep a limited number of hands employed over the winter months.

Messrs. Wood & Skinner, whose yard has been practically closed for some months past, have obtained an order for a cargo vessel, from a local company, and the initiatory arrangements for an early resumption of work are now in progress. Messrs. Anderson & Laverick have also booked an order for a small

steamer, and Messrs. Hawthorn, Leslie & Co. have been commissioned to build a vessel of large size by a Newcastle firm of shipowners. This, we believe, practically completes the list of new orders placed with shipbuilders on the Tyne this month, and it is certainly not a large programme.

Messrs. W. Dobson & Co. had a vessel ready for launching last month, but it is still on the stocks, and possibly may remain so for some time to come, as circumstances have arisen which may result in a change of ownership. The yard of Messrs. Wigham Richardson & Co. continues to be exceptionally busy, there being five vessels of large size on the stocks, and three others being fitted out in the river. The splendid steamer *Maori*, which was launched from the yard of Messrs. C. S. Swan & Hunter in August last, is now nearly ready for delivery to the owners, Messrs. Shaw, Savill & Albion Co., Limited, by whom the vessel will be employed in the colonial frozen meat trade. The building berths of Messrs. Swan & Hunter's yard are fully occupied, and in all departments of the large establishment full activity is maintained.

The line of battleship *Revenge*, left the Jarrow yard of Messrs. Palmer & Co. on the 7th inst., and is reported to have reached Portsmouth in safety, after a singularly rapid and successful voyage. For the past three or four years the Palmer's Co. have had their hands full with government contracts, and this class of work does not seem to have been commercially profitable. The working men and tradespeople of the locality have undoubtedly been benefited by the presence of so large an amount of work; but it is to be feared that there the advantage ended, and that the great firm who brought the work to the place gained little by their enterprise. Almost from the commencement of the contracts they were harassed by strikes of a peculiarly vexatious nature, and it is but truth to say that these uncalled for stoppages helped in great measure to make the contracts unremunerative. With the end of the Government contracts, it is to be hoped that a more prosperous era will be initiated, and from the cheerful tone adopted by the speakers at the last meeting of shareholders, it looks as if this change for the better had already commenced to be felt. The firm have, it is understood, been very successful in obtaining shipbuilding orders lately, and for some time past they have been enabled to keep the steel works and rolling mills in pretty regular operation.

At Messrs. Readhead's yard the keel has just been laid for an exceptionally large vessel, and as there are two others in different stages of progress on the stocks, the briskness which usually characterises this establishment is well maintained. The Edwards' Shipbuilding Co., and the Tyne Shipbuilding Co., have each three vessels of large size in progress, and at Messrs. R. Stephenson & Co.'s yard there are two berths occupied. In the repairing establishments, the amount of work in hand is somewhat limited; but it is probable that within the next few weeks work of this description will become more plentiful.

Engineering.—The state of business in the local marine engineering works is still unsatisfactory, and there is no likelihood of an improvement taking place until some stimulus is given to shipbuilding by an enlargement of commercial requirements in the matter of over-sea transit. At the Wallsend Slipway and Engineering Co.'s Works, orders are almost unprecedentedly scarce, and in the fitting shops the number of hands employed is much below the average. Very active progress is being made, however, with the construction of the new graving dock, which will be ready for opening early next year. The pumps for the dock are being supplied by Messrs. Tangye, of Birmingham, and are of the most improved pattern manufactured by that eminent firm. They are of unusually large power, and will be among the most effective appliances of the kind to be found at any graving dock in the kingdom.

The Neptune Engine Works, Low Walker; the St. Peter's Works, and Messrs. Readhead's works continue busy, and at the Palmer's Co.'s Engine-works, Jarrow, there are some indications of a coming improvement. At all the other works business is extremely dull.

In other branches of the engineering trade, restricted work is the prevailing feature, but some firms have been fortunate in securing a fair share of work, and in these exceptional instances a satisfactory state of business is maintained in the workshops. Messrs. Donkin & Co., of the St. Andrew's Engine-works, have booked further orders for steering gears during the month, and have been commissioned by Messrs. Humphreys & Tennant, of London, to build eight ash-hoisting engines for Russian warships now in course of building. This is an important order, as the engines are of exceptionally large size. Messrs. Emerson, Walker & Thompson Bros., Limited, are also favourably placed in the matter of orders, and Messrs. Carrick & Wardale are pretty busy in the department of their works which is specially devoted to the manufacture of ships' pumps. The North-Eastern Railway Engineering Works at Gateshead have, after a prolonged period of "short-time," again started on full time, a considerable addition to the ordinary work of the establishment having recently been made.

A new company, of which Mr. William Hindson, late manager at Messrs. John Abbot & Co.'s works, is the head, has been formed for the purpose of carrying on the business of hydraulic and general engineering in extensive premises at Gateshead, which were till recently occupied by Messrs. H. Charlton & Co., anchor manufacturers. The premises and plant have been purchased by the new company, who intend putting down additional machinery, and erecting a large foundry. The company will undertake most kinds of general engineering work, and will, in addition, continue the manufacture of anchors for Messrs. Charlton. A start will be made by the end of the year, and there is every reason to expect for the new venture a fair measure of success. The new works which are being got ready at Felling, for Messrs. Noble & Lund, machine tool makers, will also, it is understood, be in full operation by the end of the year. The Tyneside Shipbuilding, Ship Repairing and Engineering Co., South Shields, are rapidly getting their newly-erected premises ready for a commencement of operations, and we believe that in this case also the end of December will find the machinery going.

The Newcastle depôt of Messrs. William Reid & Co., 112, Fenchurch Street, London, continues to be kept busy, the demand for the various specialities manufactured and supplied by the firm being fully maintained. A number of Reid's patent self-lubricating sheaves have been forwarded to Russia this month in fulfilment of an order, and it is probable that this will lead to further business with that country.

Brass and copper work are moderately well employed, and some of the iron foundries are rather busier than they were a few weeks ago. In local rope works, business is fairly active.

THE WEAR.

Shipbuilding.—The Deptford yard (Mr. James Laing's) is just now the busiest establishment on the river, among the orders recently booked being one for a fast steamer which is intended for employment in the Eastern passenger service—principally, we believe, in carrying pilgrims. The vessel is of comparatively small dimensions—less than 250 ft. long—but its construction will provide more employment for skilled labour than the building of a much larger cargo boat would have done. The firm have four vessels in progress on the stocks, two of which are in early stages and of large tonnage. The s.s. *Trinidad*, which has been in the graving dock for over three months, undergoing extensive alterations, including an addition to the length of 40 ft., is almost ready for going under the sheerlegs at the Southwick Engine Works, where she will be fitted with new engines that have been constructed to propel her at a high rate of speed. The vessel, which was built by Mr. Laing in 1884, to the order of the Quebec Steam Shipping Co., has been employed in the passenger trade; but additional accommodation for passengers is now being provided, and all modern arrangements for securing the comfort and convenience of those on board are being carried out in a most complete manner. At Messrs. Doxford's yard the state of work continues satisfactory, and at Messrs. Priestman & Co.'s the building berths are fully occupied. Messrs. Short Brothers, having launched a large vessel recently which was ordered by local owners, have now only three vessels on the stocks, and there is an appearance of slightly lessened activity in all the departments. Messrs. Robert Thompson & Sons have only a limited amount of work in progress at their Southwick yard; but at the Bridge Dock there have been a good many repair contracts dealt with during the past few weeks. Messrs. J. L. Thompson & Sons have a very large vessel in the framing stage, which is said to be intended for a special service. They have three other vessels in progress, two of which are in advanced stages. One berth from which a vessel was launched lately is still vacant. There are two vessels—the s.s. *Wordsworth* and the s.s. *Kate Fawcett*, undergoing rather extensive repairs at the firm's Manors Quay works, and it is expected that there will be another important repair contract in hand very shortly. Messrs. Blumer & Co. have a medium sized vessel plated, and

another, which is being built on the speculative principle, in the framing stage. Preparations for laying down a much larger vessel than either of those now on the stocks are understood to be in progress. The erection of new workshops at Messrs. Austin's yard is being rapidly pushed forward, and the additional premises will be ready for the reception of machinery by the end of the year. At the present moment, the firm are pretty busy, there being a considerable amount of repair work in hand to supplement the new work on the stocks. The state of business at the Sunderland Shipbuilding Co.'s yard, and at Messrs. Bartram & Haswell's yard, has undergone very little change since last month, and at Messrs. Pickersgill's yard the whole of the building berths are still unoccupied. Builders of ships' boats are at present extremely slack, there being scarcely enough work in hand to keep the apprentices employed.

Engineering.—In marine engineering business continues dull, and as very few new orders are being booked, the outlook is far from reassuring. The busiest establishment is perhaps the Southwick Engine Works, where there are several sets of engines in course of construction for vessels now being built on the Wear. At the Palmer's Hill Works three locally built vessels are to be fitted with engines, &c., before the close of the year, and there are also some repair contracts to be dealt with. The engines of the s.s. *Wordsworth* have just undergone a general overhaul at this establishment. The locally owned vessel *Victoria*, which was launched on the 19th ult. from the yard of Messrs. Short Bros., is being fitted with her machinery at the Scotia Engine Works, and a vessel, shortly to be launched from Messrs. Austin's yard, will be fitted with engines, &c., at the same establishment. The smaller engineering works generally show little activity, and the same may be said of foundries, forges, and chain works. Messrs. A. Dillon & Sons are doing a steady business in the manufacture of lubricating, frictionless, and chalk packing for engines, as also in belting syrup, compositions for the prevention of incrustation in boilers, &c., and their works at North Durham Street, Sunderland, are kept regularly going.

Mr. A. A. Rickaby, of the Bloomfield Engine Works, has patented an arrangement for cooling condensed water, which is just now attracting much attention amongst local engineers, many of whom have highly commended the system, after having witnessed it in operation at the works. The water, after passing from the condenser to a receiving tank, is conveyed through a series of specially arranged coils that are exposed to the action of the atmosphere, until it reaches the "reserve tank," having undergone a thorough process of purification and cooling in the passage. The inventor claims that if the "Proell" cut off gear is used to control the engine; the adoption of this new process will result in a great saving of fuel and water. The Bloomfield works are at present very regularly employed with the manufacture of piston-rod packing (a speciality at these works), patent piston rings, &c., and several contracts are now being negotiated for the installation in local works of the new process above referred to.

The Hartlepools.—It has not transpired that any new orders of importance have been secured by the shipbuilding firms at this centre lately; but there is still a fair amount of new work in progress at the different establishments, and, as there are also repair contracts in hand, the situation is less gloomy than at some other seats of the industry. Messrs. Furness, Withy & Co., launched from their yard at Middleton, on the 12th ult., a large vessel, built to the order of the Chesapeake and Ohio Steamship Co., Limited, for the general cargo and cattle trades. The vessel is a counterpart of the s.s. *Chickahominy*, launched from the same yard, to the order of the same owners, on the 12th September last, and also of the s.s. *Appomattox*, launched on an earlier date. She is provided with all the improved appliances, and special arrangements for facilitating loading and discharging, and also for ensuring as far as possible, the safety and comfort of those on board, including the crew as well as the officers and passengers, and is in all respects a credit to the builders. The vessel, which will be engined by Messrs. Thomas Richardson & Sons, was named the *Greenbrier*.

Among other important contracts recently completed by Messrs. Thomas Richardson & Sons, the engining of the splendid steamer *Zaire*, built by Messrs. Raylton, Dixon & Co., to the order of the Empreza Nacional Steam Navigation Co., of Lisbon, deserves special mention. The engines, which were built under the superintendence of Mr. Jamieson, of Hull, are of the triple-expansion type, and are of massive design to suit the high piston speed at which they will be driven. The cylinders ... by 44 in. and 72 in. by 48 in. stroke; the high-pressure being fitted with a piston valve, and the intermediate and low-pressures with double-ported slides. A steam jacket is fitted to the H.P. cylinder, which is also provided with a circulating receiver arranged for "drying" the steam on its passage to the intermediate pressure engine. The drain from this jacket is in communication with a Morison evaporator, by which means the efficiency of the jacket is greatly increased, besides being kept free from any accumulation of water. The valve gear is of the usual double eccentric link-motion type, all the bearing surfaces being extra large. Double drag rods are fitted to each of the radius links, the reversing levers being of cast steel, and arranged with slots for altering the grades of expansion in each of the cylinders, independently. The reversing gear is of the "all-round" type, and the reversing engine is very conveniently arranged on the centre front column. Both the receivers are fitted with Geddes' pulsator economisers, which are now becoming so popular on account of the increased efficiency produced by their use, and the great advantage that results from the fact of the glands working without leakage of water. In reference to these "economisers," many owners report that the saving in packing alone soon repays the cost of fitting them. In addition to the usual pumps driven by the main engines, there are also fitted in the engine-room Weir's feed pumps, a Drysdale centrifugal pump, a duplex feed donkey by Clark, Chapman & Co., a duplex donkey of the Worthington type, and a large ballast donkey, by the builders. The boilers—two in number—are double-ended, having 12 Morison Suspension Furnaces, manufactured by the Leeds Forge Co., the working pressure being 160 lbs. The furnaces are fitted with Geddes' protector fire doors, which seem particularly suitable for marine purposes. At the trial an average speed of 14½ knots was made against a stiff breeze from the north-west. This result, which, it may be stated, was something in excess of the maximum speed anticipated, was considered eminently satisfactory. On the return journey lunch was served, and Mr. Wayman Dixon, J.P., who occupied the chair, took the opportunity of complimenting Captain Laws, who superintended her construction, on the manner in which he had discharged his duties. That gentleman, in replying, expressed the opinion that owing to the thoroughly effective way in which Messrs. Dixon and Messrs. Richardson had carried out their respective contracts, the *Zaire* was, for her size, as fine a vessel as ever sailed.

The Tees.—At Stockton, only two of the shipbuilding yards have any considerable amount of work on the stocks, and a dull time during the winter months is anticipated. Messrs. Blair & Co. are keeping steadily employed; but other engineering firms are doing only a limited business. At Middlesbro' the outlook in the shipbuilding industry is depressing, the principal yard being slacker than for some time past. Engineering works at this centre are for the most part short of work, and many of the iron and steel rolling mills are working irregularly.

Darlington.—Some orders of importance are said to have been received by an engineering firm at this centre, and it is expected that employment will soon be provided for some of the operatives now going idle. At the Darlington Forge Co.'s works business is fairly active.

MERSEY NOTES.

(From our own Correspondent.)

ALL branches of the engineering and iron trades throughout the district have during the past month been so completely disorganised by the continual coal stoppage that it is difficult to give any very reliable report as to what is just now the actual condition of trade. Some of the leading branches of engineering still continue fairly well supplied with orders, but apart from this there seems to be no great weight of new work coming forward in any department, and shipbuilding and marine engineering especially continue in an extremely depressed condition—the disastrous effects of the coal stoppage have been unmistakably shown in the very large increase of out of work members that have come upon the books of the various engineering trades union organizations. Although it is only in exceptional cases, where there has been an actual complete stoppage of any really important works, a great many of them have been all but stopped, and in most cases there has been a resort to partial stoppage or running short time, owing to the excessively high price, and difficulties of obtaining supplies of

fuel. The Amalgamated Society of Engineers have only during one period in the whole of their previous history had more unemployed members on the books than at present, the total for the whole of the Society being upwards of nine per cent., whilst in the Manchester district the position has been even still more serious, between twelve and thirteen per cent. of the total membership having been at one time on their books in receipt of out of work support. The Steam Engine Makers' Society has also to report further considerable increase of out of work members, which now amount to quite seven per cent. of the total membership. The great bulk of this increase in the number of unemployed members is set down by both Societies to the effects of the coal strike, but apart from this the general outlook of trade is reported as anything but encouraging, and in their private circulars to the men, it is admitted that the prospect before them is gloomy indeed.

In the iron market business has gradually dwindled off to the very smallest proportions, as not only have consumers been so uncertain about keeping their works going that they have bought just merely from hand to mouth, but actual requirements have been considerably curtailed by the partial stoppage of various manufacturing operations already referred to. Notwithstanding the fact that Lancashire makers of pig iron have for nearly the whole of the month been practically out of the market, and requirements of consumers for similar brands have been mainly supplied by some half-dozen district furnaces which have been kept going in Lincolnshire and Derbyshire, there has been no excessive pressure upon even this very limited production, and prices have shown no appreciable improvement. Lincolnshire makers have only been able to obtain an advance of about 1s. per ton upon their previous rates, whilst quotations for Derbyshire have not been more than firm at recent full rates, quotations for delivery in this district being now about 41s. for Lincolnshire forge, to about 42s. 6d. for foundry, and about 50s. for Derbyshire foundry, net cash. With regard to outside brands offering here, there has been very little Scotch iron coming forward, owing to vessels being largely engaged in carrying coal from Scotland, and prices there have been nominally about 47s. for both Eglington and Glengarnock, net prompt cash, delivered at the Lancashire ports, whilst in addition the make of Scotch iron is still seriously interfered with owing to the high cost of fuel. For Middlesborough iron prices, however, if anything, have tended rather in the downward direction, and delivered in this district, good foundry qualities have been readily obtainable at about 43s. 4d. to 43s. 10d. net cash.

The position in the finished iron trade has been really extraordinary. None of the Lancashire forges have been working at all for the past month, but there has been no very exceptional pressure upon the stocks held by the merchants, whilst North Staffordshire iron, which has been the main supply for this district, has only towards the close of the month been put up in price, and this was mainly due to the prospects of a continued prolonged stoppage of the collieries. For the greater part of the month, Staffordshire bars have been obtainable at £5 12s. 6d. per ton; now they have been put up to £5 17s. 6d. per ton. delivered here, whilst merchants have advanced their stock prices 10s. per ton, quotations for retail lots being now £7 per ton.

Exceptional quietness has continued throughout the steel trade and for raw material, prices have become easier, hematites at the close of the month not averaging more than 53s. 6d., less 2½ delivered. The steel plates prices have remained nominally unchanged, the best boiler-making qualities continuing to be quoted at about £6 10s. per ton, delivered to consumers in the neighbourhood.

In the metal market there has been no very material change in prices during the month, and business has been only very moderate, owing to the partial stoppage of operations at so many of the engineering works in the district. List rates for delivery in the district are as under:—solid drawn brass boiler tubes, 5½d.; solid drawn brass surface condenser tubes, 6¼d.; solid drawn copper tubes, 7½d.; brazed copper gas and steam tube, 7d.; brazed brass gas tube, 6½d.; brazed brass machine tube, 6½d.; brass wire, 5¼d.; copper wire, 6¼d.; rolled brass, 5¼d.; sheet brass, 6½d.; yellow metal bolts, 5¼d.; yellow metal condenser plates, 5¼d.; cast composition sheathing nails and spikes, 5½d.; cast red-metal sheathing nails and spikes, 7½d.; wrought copper rivets, 8½d.; wrought copper boat nails, 8½d. to 9½d.; wrought copper tacks, 11½d. to 1s. 2½d.; cut copper nails, 8d. to 9½d. per lb.; and copper bolts, £61 per ton.

In the timber trade, no improvement is noticeable, the tone of the market continuing exceedingly dull. A fair quantity of the import has gone direct from the quay to consumers, but the values realized have been unsatisfactory, and in all articles the stocks held are quite ample. There has only been one small import of East India teak, and the deliveries have been rather small, but stocks are not excessive, and prices continue fairly steady. Of greenheart there have been no arrivals, and, with a somewhat improved demand, the stock has been lessened to some extent, but it is still far too heavy, and the market is weak.

In the coal trade of course supplies for the greater portion of the past month have continued to be only obtainable from outside districts, such as Scotland, Durham, Staffordshire, and South Wales. These have been coming forward only irregularly, and large users have had considerable difficulty in covering their requirements. The result has been that works have frequently had to resort to partial stoppage whilst the prices which have been ruling have gone on steadily advancing. With the close of the month, however, there has been some important resumption of work in Lancashire, whilst the re-starting collieries in other districts has also helped to bring supplies rather more plentifully into the market. Prices, although now easier are, however, still at a prohibitive figure, so far as any definite continuance of consumption for engineering and other industrial purposes are concerned, and the latest minimum quotations are about 18s. to 18s. 6d. for engine fuel, 21s. to 22s. for steam coal, and from 23s. up to 27s. for round coals, according to quality, delivered at stations in the district. These are, of course, only temporary figures during the stoppage, and the tendency is beginning rather to be in a downward direction, which will be increased as the resumption of work extends to other collieries.

NORTH-WEST OF ENGLAND.

(*From our own Correspondent.*)

Barrow-in-Furness.—There is not much improvement to note in the shipbuilding and engineering trades in this district. During the month only one new order has been booked for an Irish Channel steamer by the Naval Construction and Armaments Co. at Barrow. They have now on the stocks only two steamers, but it is confidently expected that further orders will soon be booked. At the present time, however, there is only a very small demand for new shipping tonnage, and the competition for the orders offering is not only very keen but narrows down all prospect of being able to realise any profit on the work when undertaken. Of course, with so large an amount of shipping lying idle it is not to be expected that owners will order new ships, except in cases where they are required for special trades, or where it is necessary to supplant old-fashioned and obsolete steamers with new and economical ships, fitted with triple-expansion engines. The trade in shipbuilding has now been extremely quiet for over six months, and gradually, so far as Barrow is concerned, the activity at local yards has departed. Hopes are, however, entertained that some new orders will be secured during the autumn months, which will not only give life to the shipbuilding, but to the engineering departments of trade. The Naval Construction and Armaments Co. launched during the month the s.s. *Batanca*, the third steamer recently built by them for the British and African Steam Navigation Co. She is now receiving her engines and boilers under the 100-ton crane, in the Devonshire Dock, and will soon be equipped for sea. During the month this company has completed the work of tripling the *Clan Drummond* for Messrs. Cayzer, Irvine & Co., and in the course of a week or two the *Clan Graham* will come to Barrow to be tripled. Some repair orders are engaging attention at Barrow, and others are likely to follow. The s.s. *Rhein*, an old Western Ocean steamer, lately of the North German Lloyd fleet, is at Barrow, and will shortly be broken up. It is gratifying to the Naval Construct on and Armaments Co. at Barrow to note the great success which has attended the operations of the new sand dredger *Branker*, built for the Mersey Docks and Harbour Board. A clear channel has now been cut through the Mersey bar by means of this dredger, and now vessels of the greatest tonnage can sail right up the river at dead low water. One of the great Atlantic liners, the *Majestic*, sailed through the cut in the bar on the 28th October, and right up to her moorings off the landing stage without the slightest difficulty. The opening up of this channel through the bar will be of immense advantage to the port of Liverpool. It is probable that similar dredgers will be built for other ports where the obstruction at the

entrance is of a sandy nature, and it is not too much to expect that Barrow will secure this class of orders, as the patents in the *Brancker* are protected. The s.s. *Liverpool*, well known as a passenger steamer in the Bristol Channel and Irish trade, has been re-engined and fitted with new boilers by Messrs. Westray, Copeland & Co., Limited, for Messrs. Mawson & Son, Barrow, and will be employed in the general trade.

West Cumberland.—There is a quiet trade doing in shipbuilding at Workington and Maryport, but the demand is not brisk, nor is there any hurry for the delivery of the work in hand. At Whitehaven the shipbuilding yard is closed, and there is no likelihood of a resumption of work, as all efforts to dispose of the yard have failed.

Shipbuilding Materials.—There is a very quiet demand for shipbuilding material. Few orders are being given out and none of them to local makers. Deliveries of plates, &c., are coming to hand from Consett and elsewhere. Some interesting experiments are however being made at the Barrow Steel Works on the basis of suggestions contained in the paper of Mr. Muirhead, recently read to the Iron and Steel Institute, in which he argues in favour of the rolling of Siemens-Martin's plates, direct from ingots, which have been allowed to solidify but not cool in soaking pits alongside the furnaces. There is every reason to believe these experiments will be successful. If so, Barrow will again come to the front in the steel shipbuilding material trade, as the great drawback here is the dearness of fuel; and the adoption of soaking pits, and the manufacture of plates at one fusion direct would bring about important economies. Naturally much interest is shown in these experiments. Barrow, by reason of the valuable deposits of hematite which surround it, ought to be one of the leading places for the production of Siemens-Martin's steel, and if economies in fuel consumption can be secured, there is no doubt that this will ere long be the result.

Catalogue.—We have received a copy of the latest illustrated list of Messrs. Emerson Walker & Thompson Bros., Limited, engineers and forgemasters, of Gateshead-on-Tyne, and of London. Of course they are chiefly known by their windlasses and capstans. These we find in the list, of all sorts. Some adapted for ocean steamers, some for sailing ships, and others for yachts and trawlers. There are combinations of hand and steam power, effected so as to make the various types suitable for vessels where hand and steam are both available, or when only one can be relied upon. As a kind of subsidiary to this part of the work, we notice their stoppers of various kinds for cables, and for wire rope, and their steam cranes for cargo purposes. They however, go in for things quite outside these. There are screws for tightening rigging, steering chains and funnel stays, as well as forgings for crank shafts and stern posts. The firm are also prepared to supply Guild's Hygrometer, which is an apparatus designed to draw off the water from the cylinders, where it is a source of danger, and place it in the hot well, where it is of use in getting steam. We have already in these columns referred to this useful invention, which in a vessel whose engines indicated only 700 H.P. effected an increase of 8 per cent. in the power, of 20 per cent. in the temperature of the feed water, and a reduction of 8 per cent. in the coal consumption. In these days of close competition no one can afford to neglect such an apparatus, which whilst economizing fuel, makes the chance of an accident through the forcing of a cylinder cover remote in the highest degree.

Hull and District Institution of Engineers and Naval Architects.—The first general meeting of the present session 1893-4) was held at the Institute rooms, Bond Street, on Monday evening, October 2nd. The President, Mr. J. Spear, in the chair. After the usual business, Mr. A. V. Coster read a paper on *Boiler Furnaces, their Construction and Renewal.* Commenting on the fact that "there is nothing new under the sun," he proceeded to deal with the different classes of boiler-furnaces now made, and the various methods of flanging and rivetting them into the boilers. Having pointed out what he considered the best and worst modes, he drew special attention to the need of a good type of "withdrawable furnace," it being his opinion that such a one would greatly facilitate the repairs of boilers, and also lessen the cost of such repairs. The paper was splendidly illustrated by means of models of furnaces, diagrams, &c. (kindly supplied by Messrs. J. Brown & Co., the Leeds Forge Co., Limited, Leeds, and Messrs. C. D. Holmes & Co., Hull), to all of whom the lecturer expressed himself much indebted, both for the loan of the above and also for a quantity of information on various points. The following gentlemen took part in the discussion which followed, viz.:—Messrs. W. B. Dixon, Jas. Simpson, W. Harris, and J. Spear. A hearty vote of thanks to Mr. Coster, for his able paper, closed the meeting.

Oil Launches.—We understand that Messrs. Vosper & Co., of Portsmouth, have just achieved another success in the competition of "oil *versus* steam." Mr. J. Burbey, of West Cowes, Isle of Wight, having removed the steam machinery from his yacht the *Venture*, decided to try an oil engine, as the steam machinery would not propel the yacht against the strong river-tide at Cowes. The result has been highly satisfactory, as she will now travel at a good speed against the strongest tide and take a dinghey in tow at the same time. She is a somewhat peculiarly shaped boat, as she is built on the lifeboat principle, and was designed by her owner. With the steam machinery there was very little room in her, and she could only carry sufficient coal for a few hours steam without great inconvenience. With the oil engine as now fitted she can run 48 hours, the tank being placed in a space which could not otherwise be utilised, considerable space is now available for other purposes. There being no funnel the boat can "oil" along and sail at the same time, and further, the boat can be kept as clean as a sailing yacht. We understand that the owner was much delighted with the result of the trial, particularly remarking on the difference of the two methods, as with the oil engine he could get under way in seven minutes, and there was no blacks or smoke. We feel sure that the oil motor has a great future before it, especially for small powers.

Water-Tube Boilers.—With a view of ascertaining the best form of water-tube boiler, the Admiralty determined some time ago to supply one of the nine 56 ft. vedette boats, building by Mr. J. Samuel White, of East Cowes, with a coil boiler, constructed according to the builder's new system. The official two hours full-power trial was recently made in Stokes Bay with very satisfactory results. An ample supply of steam was furnished at a pressure of 160 lbs., with only 1·8 in of air-pressure; the mean revolutions were 530 per minute, the average speed with and against tide 14·57 knots, and the I.H.P. 210. The steadiness of the steam and the absence of priming were the subject of congratulation, while the saving in weight, the superior accessibility afforded for sweeping the heating surfaces, the immunity from leakage owing to the great elasticity of the coils of tubes, and the great saving effected in the consumption of fuel over the ordinary locomotive boiler, rendered the trial of special interest.

The Gunboat "Hebe."—The new first-class gunboat *Hebe*, which was built and engined at Sheerness Dockyard under the Naval Defence Act, was taken to sea on October 24th, for her official trial under forced draught. The *Hebe* was tested on a continuous run of three hours' duration with most satisfactory results, the engines working smoothly without hot bearings and the boilers giving a good supply of steam without priming. With a mean steam-pressure of 148 lbs., and the engines working 247 revolutions per minute, a mean of 3,544·42 H.P. was indicated, with a speed of 19 knots. These results were obtained with the use of 2·08 in. of air pressure. The *Hebe* returned into Sheerness Harbour at the conclusion of the trial to be completed for passing into the A Division of the Medway Fleet Reserve.

The Liverpool Bar.—The dredging operations at the mouth of the Mersey have quickly removed the greatest obstacle to the port of Liverpool, and vessels can now enter that port at all states of the tide. On the 18th September the *Majestic*, inward bound, crossed the bar one hour and five minutes before high water with no less than three feet of water under her bottom. There was no dragging along the mud, as we have seen happen when big steamers enter other and much vaunted ports at or near low water. Moreover, the dredging operations are not yet finished, and it will soon be possible for outward bound vessels with bunkers and store-rooms full to cross in any state of the tide even if they cannot do so already.

Warships.—From an official return of British and Foreign warships just issued, the number of battleships and coast defence ships owned by this country is 60, while of the same class of ships France and Russia possess between them 70, from which it is evident that we are far from maintaining the requisite standard of strength.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Georgian Prince.—On September 23rd there was launched from the Walker Shipyard of Sir W. G. Armstrong, Mitchell & Co., a fine steel screw steamer, which has been built for Mr. James Knott's Prince Line of steamers, and is intended principally for the carriage of petroleum in bulk, although the arrangements of the vessel are such that general cargoes may be carried when required. The principal dimensions of the vessel are—Length, 340 ft.; breadth, 42 ft.; depth, 28 ft. She has been constructed on Swan's patent system, and will take the highest class at Lloyd's Registry. The vessel has a poop, bridge, and topgallant forecastle, and will be rigged as a three-masted schooner. The propelling machinery will be of the triple-expansion type, manufactured by Messrs. Blair & Co., Stockton, and will be capable of driving the vessel at a high speed. For dealing with her cargo powerful Worthington pumps, connected to a most complete system of oil piping, are provided. The vessel will be fitted throughout with electric light by Clarke, Chapman & Co. During construction, the vessel has been inspected by Mr. M. C. James, and the machinery by Mr. John Trail. On leaving the ways the vessel was gracefully named the *Georgian Prince* by Mrs. Scott, of Manchester. After the launch the company adjourned to the model room, where the company partook of light refreshments. Mr. Henry F. Swan, director, in proposing success to the *Georgian Prince*, said, she was not the first vessel they had had the pleasure of building for Mr. Knott, and he hoped she would not be the last. He asked them to drink the health of Mr. Knott, and also of Mrs. Scott, who had come all the way from Manchester to perform the christening ceremony. Mr. Knott briefly replied for himself, whilst Mr. Scott, junr., acknowledged a similar compliment for his mother, after which the proceedings terminated.

F. C. Andersen.—On September 23rd Messrs. William Dobson & Co. launched at Low Walker-on-Tyne a steel screw steamer, which they have built to the order of Messrs. Neilsen, Andersen & Co., of Newcastle. The vessel is 182 ft. long, 26 ft. beam, and 14 ft. depth moulded. She will be supplied with triple-expansion engines, having cylinders 13½ in. 22½ in. and 36 in. diameter, by 27 in. stroke, by Messrs. George Clark & Co., of Sunderland. The vessel was christened *F. C. Andersen.*

Marion.—On September 25th Messrs. R. Cragg & Sons launched at Middlesbrough a steam trawler of the following dimensions:—107 ft. 6 in. by 20 ft. 6 in. by 11 ft. 10 in. moulded. She will be fitted by Messrs. Westgarth, English & Co., of Middlesbrough, with triple-expansion engines, having cylinders 11½ in., 17 in., and 28 in. by 20 in. stroke, with large steel boiler. The vessel was named the *Marion.*

David Mainland.—On September 26th Messrs. Wm. Gray & Co., Limited, launched a fine steel screw steamer of the following dimensions, viz.:—Length, over all, 280 ft.; breadth, 37 ft.; depth, 19 ft. 6 in. She has been built to the order of Messrs. John Coverdale & Son, of West Hartlepool, and will take Lloyd's highest class. The deck erections consist of poop, raised quarter-deck, long bridge, and topgallant forecastle. A handsome saloon, state room, and accommodation for captain and officers will be fitted up in the poop, and comfortable quarters for the engineers at the after-end of the bridge, and for the crew in the fore-end of the bridge. The hull is built with web frames, a double bottom is fitted under each hold for water ballast, and there is also a large ballast tank in the after peak. Four steam winches, donkey boiler, steam steering gear amidships, screw steering gear aft, patent windlass by Emerson Walker & Co., schooner rig, boats on beams overhead, and all modern appliances will be fitted. The engines are of the triple-expansion type, working on three cranks. They are supplied by the Central Marine Engine Works of Messrs. William Gray & Co., Limited. The cylinders are 19 in., 30½ in., and 51 in. diameter, and the piston stroke 36 in. The boilers, built of steel, are of large size, and will give an ample supply of steam at a working pressure of 160 lbs. per square inch. The vessel has been superintended during construction by Mr. Airey, of West Hartlepool, on behalf of the owners. The ceremony of naming the ship *David Mainland* was gracefully performed by Mrs. Ormesby, wife of the Rev. E. R. Ormesby, Rector of Hartlepool.

Yedra.—On September 27th this steels chooner-rigged steamer of 4,050 tons was launched at Sunderland. Owned by Mr. J. S. Barwick, of Sunderland.

Tweedside.—On September 27th there was launched by the Union Shipbuilding Co. at Blyth, to the order of the Pioneer Fishing Society, Limited, a wood steam liner of the following dimensions:—Length, 85 ft. between perpendiculars; 18 ft. beam; and 10 ft. 6 in. depth of hold. She will be fitted with compound steam screw engines by Messrs. Tweedy Brothers, of the Albert Engine Works, North Shields, having cylinders 14 in. and 29 in., with 21 in. stroke, and a large steel boiler by Messrs. Eltringham, South Shields. The vessel was named the *Tweedside.*

Ramses.—On September 27th was launched the s.s. *Ramses*, built by Messrs. Wigham, Richardson & Co., for the Deutsche Dampfschifffahrt Gesellschaft Kosmos, of Hamburg. The *Ramses* is a finely modelled steel screw steamer of 5,000 tons burden. She is 350 ft. in length by 43 ft. beam, and has well finished accommodation for a limited number of first-class passengers and for emigrants. The engines and boilers are also being constructed by Messrs. Wigham, Richardson & Co., under the superintendence of Mr. Freund, assisted by Mr. O. Peters, of Hamburg, and she will sail under the command of Captain J. T. Beelendorf. The *Ramses* is the first vessel built by Messrs. Wigham, Richardson & Co. for foreign account which has been fitted with their well-known four-cranked balanced quadruple-expansion engines, which type has long been so successful in steamers owned in England.

Mark.—On September 28th Messrs. Sir W. G. Armstrong, Mitchell & Co., launched on the Tyne a steel screw steamer, built to the order of the Norddeutscher Lloyd of Bremen, and intended for their passenger and cargo trade to South America. The principal dimensions of the vessel are:—Length, 376 ft.; breadth, 43 ft. 6 in.; depth, 28 ft. 6 in. The vessel has been built under special survey for the highest class at Lloyd's Registry as a three-decked ship. She will have a Board of Trade passenger certificate, and besides will conform to the German and American requirements for passengers, as well as the German Board of Trade. The vessel, which was named *Mark*, was taken to the engine works to receive her machinery, which will give her a speed of 12½ knots per hour.

Rothenfels.—On Monday, October 9th, there was launched from the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesbrough, a very fine steel screw steamer of the spar-deck type, which has been built to the order of the Hansa Steamship Co., of Bremen, this being the second vessel of about the same size which these builders have this year built for the same owners, and they have now on the stocks a sister steamer to that launched. The principal dimensions are:—Length, 327 ft., by 41 ft. 9 in. beam, by 28 ft. 6 in. depth, moulded. The spar deck is of steel sheathed with teak. The main deck is of steel. The poop, bridge and forecastle decks being of teak. Web frames are fitted in lieu of hold beams, and the vessel has a carrying capacity of about 4,500 tons. Handsome accommodation is provided for the captain, officers, and engineers, and a few passengers. Engines will be fitted by Messrs. Thomas Richardson & Sons, of Hartlepool, the cylinders being 24 in., 38 in., and 64 in. by 42 in., with two large steel boilers working at 160 lbs. pressure. As the steamer was leaving the ways she was named the *Rothenfels.*

Kilburn.—On October 10th Messrs. Ropner & Sons launched at Stockton-on-Tees a spar-decked steel screw steamer of the following dimensions, viz.:—Length between perpendiculars, 330 ft.; breadth, 43 ft.; and depth moulded, 29 ft. 6 in. She will be classed 100 A1 at Lloyd's, and carry over 5,000 tons deadweight on Lloyd's freeboard. She will be fitted with triple-expansion engines by Messrs. Blair & Co., Limited, of 1,200 I.H.P. The vessel, which has been built for London owners, was christened *Kilburn.*

Tasmania.—On October 10th Messrs. Cochrane & Cooper launched at Grovehill an iron steam trawler, built for the International Steam Trawling Co., Grimsby. The dimensions of the vessel are as follow:—Length, 100 ft.; beam, 20 ft. 6 in.; depth of hold, 11 ft. She will be fitted with engines of 45 H.P. by Messrs. C. D. Holmes & Co., of Hull, and classed 100 A1 at Lloyd's. She was named *Tasmania.*

Buteshire.—On October 10th Messrs. R. & W. Hawthorn, Leslie & Co., Limited, launched a very large carrying steamer at Hebburn-on-Tyne. The vessel is a sister ship to the *Perth-*

shire, now finishing at this yard, and her dimensions are—430 ft. by 54 ft. by 32 ft. She has been built to the order of Messrs. Turnbull, Martin & Co., of London and Glasgow, for their Australian trade, and specially fitted for carrying frozen meat. The machinery consists of a set of triple-expansion engines capable of indicating upwards of 3,000 H.P. The vessel was named *Buteshire*.

Tyne Castle.—On October 10th there was launched by Messrs. Edwards Bros. at North Shields a screw trawler, which has been built to the order of the Tyne Fishing Co., of North Shields. The vessel is fitted with triple-expansion engines, and is the first of two boats which this firm has in hand for the company. The vessel was named the *Tyne Castle*.

Celte.—On Thursday, October 12th, there was launched from the yard of the Sunderland Shipbuilding Co., Limited, a steel screw steamer, built to the order of Messrs. Chevillotte Freres, of Brest, her principal dimensions are:—Length, 210 ft.; breadth, 31 ft.; depth, 17 ft. 6 in.; built to the highest class French Veritas, having raised quarter-deck, bridge and topgallant forecastle, water ballast, all fore and aft, and also in both peak tanks, accommodation for captain, officers, engineers, and a few passengers in the bridge-house, the saloon is panelled out entirely in different shades of solid oak, the crew is berthed in the forecastle as usual. The vessel is for the owners French Coasting line, is fitted for carrying wine cargoes, has direct steam windlass, by Emerson, Walker & Co., steam steering gear, steam winches, and all the usual appliances for rapid loading and discharging. Tri-compound engines are supplied by the North Eastern Marine Engineering Co., Limited, of Sunderland, having cylinders 18½ in., 30 in., and 49 in., by 33 in. stroke, steam being supplied by an extra large boiler working at a pressure of 160 lbs. per square inch. During progress, both hull and machinery have been under the personal superintendence of Monsr. Jonnet. Upon leaving the ways, she was named *Celte* by Mrs. Easton R. Kirkley.

Greenbrier.—On Thursday, October 12th, Messrs. Furness, Withy & Co., Limited, launched from Middleton Shipyard, Hartlepool, the last of three fine steel screw steamers built to the order of the Chesapeake & Ohio Steamship Co., Limited, London, for the general cargo and cattle trade, particulars of which were given in our accounts of the launches of the s.s. *Appomattox* and the s.s. *Chickahominy* in our September and October numbers. The vessel will be fitted with triple-expansion engines by Messrs. T. Richardson & Sons, and it is anticipated a sea speed of 12 knots will be easily obtained. On leaving the ways the vessel was gracefully christened *Greenbrier* by Mrs. Thomas Furness, wife of Alderman Furness.

Cacique.—On October 12th there was launched by Messrs. Joseph L. Thompson & Sons, at Sunderland, a steel screw steamer, built to the order of the New York and Pacific Steamship Co., Limited. The vessel is of the spar-deck type, and of the following dimensions, viz.:—Length, 334 ft.; breadth, 42 ft. 6 in.; depth, 28 ft. 6 in., and has been built under special survey for Lloyd's highest classification. The engines, by Mr. John Dickinson, are of the triple-expansion type, having cylinders 24½ in., 40 in., and 66 in. diameter respectively, with a stroke of 45 in. The vessel was named the *Cacique*.

Victoria.—On October 13th Messrs. Short Brothers launched at Sunderland a steel screw steamer, built to the order of Messrs. Taylor & Sanderson, of Sunderland. The vessel, which was named *Victoria*, was towed to the Scotia Engine Works, where she will be fitted with engines and boilers by Messrs. W. Allan & Co.

Citizen.—On October 14th there was launched by Mr. Richard Dunstan, at Thorne, an English oak-built vessel, to the order of Mr. W. J. Warrener, of Lincoln. Her dimensions are:—Length, 74 ft.; beam, 15 ft.; depth, 6 ft. 8 in. The vessel was christened the *Citizen*.

Cornubia.—On October 18th there was launched by Messrs. Anderson, Laverick & Co., Limited, at Newcastle-on-Tyne, a steel screw coasting steamer named the *Cornubia*, which has been built to the order of Mr. J. H. Bennetts, Penzance. The vessel is built to class 100 A1 at Lloyd's, and is of the following dimensions:—125 ft. long by 24 ft. broad, 9 ft. 6 in. depth moulded, and is fitted complete with all latest improvements for vessels of her class. Engines of the compound surface-condensing type have been put in, having cylinders 14 in. and 28 in. by 20 in. stroke, with steel multitubular boiler 10 ft. 6 in. diameter by 9 ft. long, working at 120 lbs. pressure. The foregoing machinery, it is anticipated, will drive the vessel at a speed of 9 knots loaded, and the carrying power of the craft will be about 360 tons deadweight on a 9 ft. 7 in. draught.

Castanos.—On October 26th Messrs. William Gray & Co. Limited, launched the fine large steel screw steamer *Castanos*, which they have built to the order of Messrs. Morel Bros., of Cardiff. She is a vessel of similar model and capacity to the s.s. *Penarth*, which the builders have recently delivered to the same owners, and which is giving great satisfaction by her performances. She will take Lloyd's highest class, and is of the following dimensions, viz.:—Length over all, 335 ft.; breadth, 42 ft. 6 in.; depth, 26 ft. 10 in.; and the deck erections consist of a bridge over the machinery space and a topgallant forecastle. A handsome saloon and state rooms, together with the captain and officers' rooms, will be fitted under the bridge. The hull is built with web frames and double bottom under each hold for water ballast. Large hatchways are fitted, five steam winches, steam steering-gear amidships and screw gear aft, patent direct steam windlass, two donkey boilers, shifting boards throughout, stockless anchors and a complete outfit will be fitted for a first-class cargo boat. Five engines on the three cylinder triple expansion principle are being supplied by the Central Marine Engine Works of William Gray & Co., Limited. They will develop over 1,200 H.P. The cylinders are 24 in., 38 in., and 64 in. diameter with a piston stroke of 42 in., and five large steel boilers having a pressure of 160 lbs. per square inch will give an ample supply of steam. The construction of the ship and machinery have been under the superintendence of Mr. F. Good, on behalf of the owners, and the ceremony of christening the steamer *Castanos* was gracefully performed by Miss Firth, The Flush, Heckmondwike.

Courtfield.—On October 26th Messrs. Richardson, Duck & Co., launched from their yard a steel screw steamer of the following dimensions, viz.:—Length over all, 342 ft.; beam extreme, 43 ft.; depth moulded, 28 ft. 9 in.; gross tonnage, 3,280 tons. This vessel, which has been built to the order of Messrs. Harris & Dixon, London, will be classed 100 A1 on Lloyd's Register, and has been built under special survey. She is of the spar deck type, having a deck-house aft for captain and passengers; a long bridge covering engines and boilers, with engineers and officers berthed at after end, and a topgallant forecastle for crew. Vessel will be rigged as a schooner, has a double bottom for water ballast on the Macintyre principle, and her equipment includes five steam winches, large donkey boiler, steam windlass, steam steering gear, double derricks, stockless anchors, light tower on forecastle, and every modern appliance for speedy loading, discharging, and manœuvring. She has been superintended during construction by Mr. H. M. Rogers, the owners' superintendent. Captain Sheldrake, the senior captain in the owners employ, will overlook the fitting out, and when completed, will take command. As the vessel was leaving the ways she was christened *Courtfield*, by Miss H. G. Rogers, of Bromley, Kent, sister of Mr. H. M. Rogers.

Prince.—There was lately launched from the patent slip of Messrs. G. Napier & Son, Crosshouse, Southampton, a steel screw passenger vessel, named the *Prince*, of the following dimensions:—Length, over all, 70 ft.; breadth, extreme, 16 ft.; depth, moulded, 6 ft. 3 in.; draught, 5 ft. aft and 3 ft. forward. The vessel and machinery have been built to meet the requirements of the Board of Trade for passenger service, and is certificated to carry nearly 200 passengers. The engines are of the compound surface-condensing type, with cylinders 10 in. and 20 in. by 12 in. stroke; and the boiler of the return-tube marine type, with 123 lbs. working pressure. The entire machinery and two commodious cabins—one forward and one aft—with a passage between same, are covered in by a raised deck, and are all well ventilated and lighted by sliding glass lights in the sides of the raised deck. Seats are provided forward and aft, and the top of the raised deck at the sides forms seats for the whole length. Seats are also provided on the raised deck. The steering wheel is placed forward of the funnel on the raised deck, the tiller being fitted under the main deck. The vessel has been built to the order of the Gosport and Portsea Watermen's Steam Launch Co., and on October 10th she was taken on the measured mile with the directors on board, and although it was blowing rather hard with a choppy sea, the mean speed attained was just over nine knots, or 10½ statute miles, this being considered highly satisfactory, taking into account the smallness of the propeller, due

to the light draught of water. After the trial the company on board sat down to lunch in one of the cabins. Colonel Mumby, chairman of the directors, who presided, in the course of the proceedings proposed the health of the builders and designer of the *Prince*, expressing his and the directors' warm approval of the vessel and her performances that day in every particular. Afterwards the vessel was formally handed over ready for immediate service. The *Prince* has been built to the design and under the superintendence of Mr. Herbert P. Blake, M.I.N.A., of Southampton, and both machinery and hull have been entirely constructed by Messrs. Napier & Son.

Batanga.—The screw steamer *Batanga*, the last of three vessels built for the African Steam Navigation Co., Limited, of Glasgow, has been launched by the Naval Construction & Armaments Co. at Barrow. The *Batanga* is 336 ft. long, 39 ft. 3 in. beam, 25 ft. depth moulded, and is built to the highest class at Lloyd's. She will be supplied by inverted direct-acting triple-expansion engines, having cylinders 23 in., 38 in., and 63 in. in diameter, by 42 in. stroke, capable of developing 1,600 H.P., which are designed to drive the ship 11½ knots loaded.

LAUNCHES—Scotch.

Benlea.—On September 27th there was launched from the shipbuilding yard of Messrs. Barclay, Curle & Co., Whiteinch, a splendid full-rigged three-masted ship, to the order of Messrs. Watson Brothers, of Glasgow, for their well-known "Ben" line of sailing vessels. She has been built under the personal supervision of Captain Shaw, and is fitted up with all the most approved gear for the rapid working of cargo, and, being classed British standard with the British Corporation, and 100 A1 at Lloyd's, she is an exceptionally well-equipped vessel. The register dimensions are 284 ft. by 42·3 ft. by 24·5 ft., with a tonnage of about 2,050 tons, and she will carry, when fully laden, deadweight to the large amount of over 3,800 tons. She has a full East India outfit, and is fitted with numerous labour-saving appliances for expeditious handling aloft, among which are Shaw & Hastie's patent halyard winches at each mast for hoisting and lowering the topsail and topgallant sailyards, each yard having an independent winch of its own; and another apparatus, which we believe to be somewhat of a novelty, is a winch, patented by the same parties, and made by Hastie, of Greenock, for bracing the fore, main, and mizzen lower yards. On leaving the ways the vessel was gracefully named the *Benlea* by Miss Watson, daughter of Mr. John E. Watson, chartered accountant, Glasgow.

Wellpark.—On September 28th Messrs. Scott & Co., shipbuilders, Greenock, launched from their east yard a screw steamer of 850 tons for the Wellpark Steamship Co., of which Messrs. J. & J. Denholm, Greenock, are managers. The vessel, which was named the *Wellpark*, is of the following dimensions: Length, 212 ft.; breadth, 31 ft.; and depth, 14 ft. 10 in. She has a carrying capacity of 1,250 tons, and will be supplied by the builders with triple-expansion engines, cylinders 16 in., 26 in., and 44 in., and 33 in. stroke. The new vessel is intended for the Baltic trade, and a sister ship for the same owners, and which is to be named the *Glenpark*, is approaching completion. The christening ceremony was performed by Mrs. Denholm.

Pioneer.—On September 28th there was launched from the building yard of Messrs. Forbes & Birnie, Peterhead, the first vessel of the Steam Line Fishing Co., Limited. She is 87 ft. long, and has a net tonnage of 71 tons. Mrs. Robert Gray, wife of the manager of the company, christened the steamer the *Pioneer*.

Ringsend.—On September 29th Messrs. John Fullerton & Co. launched from their yard at Paisley a steel screw steamer of about 400 tons, which has been constructed to the order of Messrs. Wallace Brothers, Limited, London, Liverpool, and Dublin, for their coal-carrying trade there, and which is fitted with all the necessary appliances, including windlass and steam steering gear by Messrs. Thos. Reid & Sons, Paisley. Compound engines of 75 N.H.P. are to be supplied by Messrs. Ross & Duncan, Govan, where the steamer will be taken to have same fitted. The steamer was named the *Ringsend* by Miss Briggs, 123, New Bond Street, London.

Glenard.—On September 30th Messrs. A. Rodger & Co., Port-Glasgow, launched a three-masted steel sailing ship of about 1,800 tons register, to carry 3,200 tons deadweight. Dimensions:—Length, 266 ft.; breadth, 40 ft.; depth, 23 ft. On leaving the ways the ceremony of naming the vessel *Glenard* was gracefully performed by Miss Hyslop, of Bank House, New Cumnock. The vessel, which will fit out and load at Port-Glasgow for Buenos Ayres, is for the Glenard Shipping Co.

Lucie et Marie.—On October 2nd there was launched from the shipbuilding yard of Messrs. A. M'Millan & Son, Limited, Dumbarton, a steel screw steamer of about 1,600 tons, which has been built to the order of Worms, Josse & Co., of Paris, and is intended for their Continental trade. The vessel on leaving the ways was named the *Lucie et Marie*, the christening ceremony being performed by Mrs. de Saint Jean, wife of Captain E. de Saint Jean, who is to command the vessel on completion. The machinery is by Messrs. David Rowan & Son, Glasgow.

Arranmore.—On October 3rd Messrs. Russell & Co. launched from Kingston Yard a three-masted steel sailing barque named *Arranmore* for Messrs. Thomson, Dickie & Co., Glasgow. Dimensions—262 ft. by 39 ft. by 23 ft., of 1,786 tons register, to carry 3,100 tons cargo, fitted with patent capstan windlass by Emerson Walker & Co. This vessel is sister ship to the *Largiemore*, built some months ago by Messrs. Russell & Co., for the same owners.

Barges for the Dundee Harbour Trustees.—On October 9th two barges, built for the Dundee Harbour Trustees, were launched from the yard of the Montrose Shipbuilding Co., Limited. Both are built on the same pattern, and are strongly constructed of steel and iron, with heavy scantlings, and are stiffened inside and outside with larch and elm fenders. One of the barges is 50 ft. long by 16 ft. 8 in. broad and 5 ft. deep; while the other is 45 ft. long by 16 ft. 8 in. broad and 5 ft. deep. The company are also building three steam screw tugs for London owners. They will be built of steel, and will be employed in towing barges on the river Thames. The size of the tugs will be:—Length, 73 ft.; breadth, 16 ft. 3 in.; and depth, 8 ft. 2 in.

Pass of Killiecrankie.—On October 10th Messrs. Robert Duncan & Co., shipbuilders, Port-Glasgow, launched at high water a three-masted steel sailing ship named *Pass of Killiecrankie*, for the Pass Line of Messrs. Gibson & Clark, Glasgow. Dimensions:—Length, 252 ft.; width, 38 ft. 9 in.; depth, 22 ft. 6 in.; of 1,620 register tonnage, to carry about 2,850 tons cargo. After the launch the vessel was towed to Greenock to mast. The *Pass of Brander* and the *Pass of Balmaha* were built by Messrs. Robert Duncan & Co., for the same owners.

Kittiwake.—On October 10th Messrs. Scott & Co., Greenock, launched an auxiliary steam schooner yacht, called the *Kittiwake*, to the order of Lord Carnegie. Dimensions:—Length, 120 ft. 9 in.; breadth, 21 ft. 2 in.; depth, 12 ft.; gross registered tonnage, 179·69; Thames measurement, 240 tons. The builder will supply triple-expansion engines of 160 H.P., the diameter of the cylinders being 9½ in., 15 in., and 24½ in. respectively, with a piston stroke of 18 in. The *Kittiwake* will also have large sail power.

Bahama.—On October 10th Messrs. Russell & Co. launched from their Greenock Yard a four-masted steel sailing ship, called the *Bahama*, for Messrs. P. Denniston & Co., Glasgow. Dimensions:—Length, 278 ft.; breadth, 42 ft.; depth, 24 ft. 2 in.; of 2,200 tons register and 3,700 tons deadweight. The *Bahama* will be commanded by Captain Jenns, now on the *Bandaneira*. When fitted up she will proceed to New York and load case oil for Japan. The keel of a steamer of 6,000 tons deadweight will be laid on the vacated berth.

Kate.—On October 11th Mr. Adam Marr launched at Leith a steam line fishing boat to the order of Mr. John Lewis, boatbuilder, Aberdeen. The length of the boat between perpendiculars is 86 ft., breadth 19 ft., depth 10 ft. The vessel, which was named the *Kate*, will be fitted with machinery by Messrs. Hall, Russell & Co., Aberdeen.

Hutton.—On October 11th Messrs. Wm. Simons & Co., Renfrew, launched complete from their yard the paddle ferry steamer *Hutton*, constructed to the order of the London County Council, for service on the river Thames at Woolwich. This vessel forms one of a fleet of three which the London County Council have provided for the public and by which passengers and vehicles are carried across the Thames without charge. The dimensions of the vessel are as follows:—Length, 170 ft.; breadth over all, 58 ft.; depth, 7 ft. 3 in. It has a capacity to carry 130 tons

of live load (that is, 70 tons for vehicles on the upper deck and 60 tons for passengers on the main deck.) It is constructed of steel under special survey of Lloyd's and the Board of Trade. It has a flush deck and a large deck-house amidships. The main deck is sponsoned out flush with the paddle-boxes and the bulwarks run in a fair line with the paddle-boxes from stem to stern. The upper deck is plated with corrugated plates filled in with asphalte and sand upon which creosoted memel blocks are laid. Six sets of sliding gangway doors, three on either side, are provided for the vehicle traffic, the passengers gangways being placed on the main deck. The boat is intended to embark and land its traffic on floating pontoons (having girderwork approaches) stationed on each side of the river. The vessel is fitted with two pairs of engines, each working independently and are provided with separate surface condensers, also independent combined air and circulating pumps. They are intended to propel the vessel at a speed of 8½ knots per hour and develop over 600 I.H.P. The paddle shafts are of mild steel, the floats being on the feathering principle. Steam is supplied by two steel boilers. Starting and reversing gear is arranged with link motion and fitted with steam gear for readily handling the engines independently and controlled by levers suitably placed on main deck. A most complete electric light installation has been provided. The order for this vessel was placed with Messrs. Simons & Co. at the end of March last, and it has been completed under the contract time. The naming ceremony was performed by Mrs. William Brown, of Meadowflat, Renfrew.

Bertha.—On Thursday, October 12th, Messrs. Cumming & Ellis launched from their shipyard at Inverkeithing another handsomely modelled steel barquentine to carry 400 tons deadweight on a draught of 10 ft., the principal dimensions being 125 ft. by 25 ft. by 11 ft. 1 in. moulded. The vessel has been built to the 100 A1 class at Lloyd's special survey and to Board of Trade requirements in all respects. She is intended for the South American trade and is fitted out similar in all respects to the *Marie Louise* and *Senorita*, recently launched by this firm. As above mentioned she is barquentine rigged, lower masts, bowsprit, yards, etc. being of steel and all the rigging throughout being of steel wire in accordance with Lloyd's requirements. The captain and officers are berthed in a spacious deckhouse aft, neatly and beautifully fitted up in every way; the crew being berthed in another deckhouse forward. All the deck fittings about the vessel are of the most modern description and by well-known makers, including patent capstan windlass by Emerson Walker & Co., and she will be completely fitted out for the trade in which she is intended for. As the vessel left the ways she was gracefully christened the *Bertha* by Miss Agnes Bleloch, daughter of Provost Bleloch, Inverkeithing. After the launch, the visitors adjourned to the builders' model room, where the usual toasts customary on such occasions were given and responded to. The vessel is built to the order of Messrs. Sauerland Gebruder, of Hamburg, and will be commanded by Captain Hansen, who has superintended the construction, and is expected to be ready for sea in the course of a fortnight hence.

Queen Olga.—On October 12th Messrs. William Denny & Brothers launched from the Leven Shipbuilding Yard, Dumbarton, the *Queen Olga*, a steel screw-steamer for the Russian Steam Navigation and Trading Co., of Odessa and St. Petersburg. The launching ceremony was gracefully performed by Mrs. Crookson, wife of the company's resident engineering inspector. The vessel's dimensions are 360 ft. by 45 ft. by 30 ft. 1 in. She is intended for the company's service between Odessa, Constantinople, and Alexandria, and is most luxuriously furnished for 60 first-class passengers in the citadel and 40 second-class in the poop, while 300 emigrants are provided for in the main deck forward. She will be propelled by a set of triple-expansion engines of large power made by Messrs. Denny & Co.

Ancona.—On October 16th Messrs. Russell & Co. launched from their Greenock yard a four-masted awning-deck ship, named *Ancona*, to the order of Messrs. G. T. Soley & Co., Liverpool, for their general trade. Dimensions:—Length, 281 ft.; breadth, 45 ft.; depth to main deck, 23 ft.; to the awning deck, 30 ft., and of 2,850 tons gross. The *Ancona* is fitted with deep hold tanks for carrying water ballast.

'shire.—On October 16th Messrs. John Fullerton & Co. d at Paisley an iron screw-steamer of 400 tons ment for Liverpool owners, specially adapted for the coasting trade, and fitted with steam windlass and steam steering gear by Messrs. Thomas Reid & Sons, Paisley. Compound engines of about 70 N.H.P. will be supplied by Messrs. Ross & Duncan, Govan. The steamer was named the *Yorkshire* by Mrs. Fullerton, Abbotsburn, Paisley.

Corso.—On October 17th the Campbeltown Shipbuilding Co. launched, from their yard at Campbeltown (Clyde), a handsomely modelled steel screw steamer of 1,950 tons deadweight. The engines, which are triple-expansion, have been supplied by Messrs. Kincaid & Co., Limited, Clyde Foundry, Greenock. The steamer has long raised quarter-deck aft, and partial awning-deck forward, water ballast in cellular double bottom, complete and speedy pumping arrangements, and steam and screw steering gears. All the latest improvements for navigating the ship economically, and for the speedy loading and discharging of cargo, including large steam winches. Steam will be supplied by suitable boilers working at a pressure of 160 lbs. The average speed, loaded at sea, is to be 9½ knots, on a small consumption of fuel. The vessel has been built to class 100 A1 at Lloyd's, under special survey, for Messrs. G. H. Wills & Co., Cardiff, and is intended for their general trade. Captain Rich, who is to take command of the vessel, has superintended her completion. The steamer was gracefully named *Corso* by Miss Gladys Wills, daughter of the owner.

White Rose.—On October 21st Messrs. David J. Dunlop & Co., engineers and shipbuilders, Inch Works Port-Glasgow, launched from their works a steel steam screw tug, built to the order of Messrs. A. & W. Dudgeon, London, for service at the Tilbury Docks, London. The following are the principal dimensions:—Length, 63 ft.; breadth, 15 ft.; depth moulded, 8 ft. 3 in. The engines, which are on the compound principle, have cylinders 15 in. and 30 in. by 18 in. stroke, the boiler being 10 ft. diameter by 8 ft. 6 in. long. The I.H.P. expected on trial is 300. As the vessel left the ways she was christened *White Rose* by Miss Lyle, of Inglehome, Greenock.

Lumaco.—On October 21st, Messrs. R. Napier & Sons launched from their shipyard at Govan the first of two steel twin-screw steamers they are building for the Compania and Americana de Vapores, of Valparaiso. The vessel has been built to the instructions of Mr. Thomas Dewsbury, Leeds, and has been specially designed to meet the requirements of the company's Pacific coasting trade, being intended to carry a large cargo on a light draught of water, while comfortable accommodation has been provided amidships for the passengers. The principal dimensions are—Length, 170 ft.; breadth, 32 ft.; depth to awning deck, 17 ft. 6 in.; tonnage about 750 tons. The machinery, which has been constructed at the builders' Lancefield works, consists of two sets of triple-expansion engines, and a single ended steel boiler for a working pressure of 150 lbs. with all the most modern improvements to attain efficiency and economy. The ship was named the *Lomaco* by Miss Milne, and after a successful launch was towed up the harbour to receive her machinery.

Benmohr.—On October 24th Messrs. Alex Stephen & Sons launched a fine steel screw steamer for Messrs. Wm. Thomson & Co., Leith, being the fifth vessel built at Linthouse for Messrs. Thomson's "Ben" line, trading to China and Japan The dimensions of the new steamer are 330 ft. by 41 ft. 9 in. by 27 ft., with engines having cylinders 25 in., 41 in., and 67 in. diameter, by 42 in. stroke, supplied with steam from two boilers suitable for 160 lbs. pressure. There is a full poop for cargo. Under the fore part of bridge the saloon, passengers' cabins, and captain's room are fitted up in a very superior style, and at the after-end comfortable and airy accommodation is provided for officers and engineers, a topgallant forecastle affording excellent quarters for seamen and firemen. The vessel is built in excess of the requirements for the highest or 100 A1 class three deck rule in Lloyd's, and also takes a Board of Trade passenger certificate. In keeping with Messrs. Thomson's usage, she has a clipper bow with graceful figurehead, and, being of elegant design, she has an unusually pleasing appearance afloat. She is fitted with every modern and improved appliance for efficiency in working at sea and in port. She was gracefully named the *Benmohr* by Miss Sarah W. Thomson, daughter of J. W. Thomson, Esq., of Glenpark. The machinery being on board before launching, the *Benmohr* is to sail next week for China and Japan, under command of Captain John Clark, Commodore of the "Ben" fleet.

Eskdale.—On October 25th Messrs. Charles Connell & Co. launched from their Scotstoun Shipbuilding Yard, Whiteinch

a handsome steel screw steamer, built to the order of Messrs. Robert MacKill & Co., shipowners, Glasgow. Her dimensions are :—Length, 320 ft.; breadth, 42 ft.; depth moulded, 23 ft. 8 in., with a deadweight capacity of about 4,500 tons. She has been built to Lloyd's highest class as a partial awning-deck steamer, with a full poop, raised quarter-deck, and long bridge extending to stern. She has a cellular double bottom right fore and aft for water ballast, and is fitted with five double-cylinder horizontal steam winches, steam windlass, Muir & Caldwell's combined steam and hand steering gear, and all the most recent appliances for the rapid and efficient working of ship and cargo. The captain and officers' rooms and state room accommodation are fitted up in a tasteful and comfortable manner in the poop, while the seamen and firemen are located in the forecastle. The engines, which are of the most improved triple-expansion type, having cylinders 23 in., 38 in., and 62 in. diameter by 42 in. stroke, worked by two single-ended boilers, are being constructed by Messrs. David Rowan & Sons, engineers, Glasgow. As the steamer left the ways she was named *Eskdale*, in the customary manner, by Mrs. Kennedy Chesters, New Kilpatrick.

LAUNCHES—Irish.

Inca.—On October 12th Messrs. Harland & Wolff launched from the south end of the Queen's Island a cargo steamer for the Pacific Steam Navigation Co. The new vessel, which is named the *Inca*, will have a gross tonnage of about 3,600, and will be driven by a set of triple-expansion engines, made by the builders, of 1,900 I.H.P.; the propeller being of manganese bronze. She will have two masts, schooner rigged, and will be provided with steam windlass, steam winches, and every facility for the rapid handling of cargo; she will also be lighted throughout by the electric light. The *Inca* is intended to run between Liverpool and ports along the western coast of South America, and is the sixth boat for the same service launched from the Queen's Island within the past ten months. Mr. Hugh Brown was present at the launch on behalf of the owners.

Ormiston.—On October 25th, at high water, Messrs. Workman, Clark & Co., Limited, launched from their shipbuilding yard, at Spencer Basin, a large steel-screw steamer named the *Ormiston*, built to the order of Messrs. R. & C. Allan, of Glasgow. The *Ormiston* is a sister ship to the *Ormidale*, recently constructed for the same firm. The registered dimensions are: Length, 361 ft.; breadth, 44 ft. 5 in.; depth of hold, 26 ft. 5 in.; gross tonnage, 3,560. She is built to Lloyd's 100 A1 class, and to the B.S. Class of the British Corporation, and is of the three-deck type, with poop, bridge, and topgallant forecastle. Cellular double bottom for water ballast all fore and aft. The upper and main decks are of steel, the upper also being sheathed with teak. The vessel has been constructed on the deep-frame system, thus leaving the lower hold clear of beams with good stowage for cargo. Each hatch is equipped with winches and derricks completely arranged for speedy loading and discharging. The captain and officers are housed amidships under the bridge, and the crew forward. The *Ormiston* is fitted throughout with a complete installation of electric light. The machinery has been constructed at Messrs. Workman, Clark & Co.'s Engine Works, and consists of triple-expansion engines of the most modern type, Steam is supplied from two steel boilers at a working pressure of 180 lbs., and are fitted with Messrs. James Howden & Co.'s system of forced draught.

LAUNCH—Danish.

Virgo.—On Wednesday, October 4th, there was launched from the yard of the Elsinore Shipbuilding and Engineering Co., Elsinore, Denmark, the steel screw steamer *Virgo*, built to the order of the Stella Steamship Co., Gothenburg, Sweden. The dimensions are:—Length, 146 ft.; breadth, 24 ft. 6 in.; depth, 12 ft. 9 in. The vessel has a carrying capacity of 520 tons deadweight, on a mean draught of 13 ft. She is built with raised quarter-deck, bridge, and forecastle, water ballast in double bottom under after-hold, and engine and boiler space and both peaks. Main and quarter-decks are of iron, and portable beams are fitted in holds for carrying a 'tween deck when loaded with herrings. Accommodation for captain and officers is neatly fitted up under the bridge, and the crew is berthed in the forecastle. She is rigged as a fore-and-aft schooner. The vessel is designed to travel a speed of 10 knots per hour with a light cargo. Her machinery consists of a set of triple-expansion engines, with cylinders 13½ in., 21½ in., 36 in. and stroke of 24 in. Steam is supplied by one boiler, working with a pressure of 160 lbs. One tubular donkey boiler supplies steam to the three winches. Steam steering gear is fitted on the bridge and screw gear aft. Ship and machinery are built to the highest class in Bureau Veritas, and under supervision of the owners' representative, Mr. D. Normann, of Gothenburg.

LAUNCH—German.

Brunhilde.—On September 15th there was launched a new steel cargo steamer by the Flensburg Shipbuilding Co. This vessel was built to the Steamship Co. of 1889 in Hamburg, and has following dimensions:—243 ft. by 34 ft. by 17 ft. The triple-expansion engine is built by the Flensburg Shipbuilding Co., and will indicate 500 H.P. As the steamer started on the ways she was christened by Mrs. Kothe, the wife of the managing owner. Directly after the launch, the keel for a sister ship was laid on the blocks for the new started Steamship Co., *Carnia* of Copenhagen.

TRIAL TRIPS.

U.S. Gunboat Castine.—On September 15th the U.S. gunboat *Castine* underwent her four hours forced draft official speed trial on Long Island Sound in very unfavourable weather. The result was a great surprise to the American shipping community, as she exceeded her contract speed by over three knots, a record unequalled by any boat of the new U.S. Navy. The vessel was designed to develop a speed of 13 knots, with 1,600 I.H.P., and 200 revolutions of the engines per minute, but on her trial she averaged the remarkable high speed of 16·032 knots, with 2,200 I.H.P., and 238 revolutions, the boilers, which are of the modified locomotive type, keeping the pressure at the Government limit of 168 lbs. to the square inch. The *Castine* is a small twin screw cruising gunboat of the first class, and on a small displacement she carries a powerful battery of heavy, rapid-firing guns, and a large supply of coal. Her principal dimensions are:—Length, 190 ft. (water-line); beam, 32 ft.; mean draught, 12 ft. 1 in.; corresponding displacement, 1,052 tons. She is constructed entirely of steel, and is protected by a heavy, rounded deck just below the water-line, and a 36 in. cofferdam fitted above, whilst the coal is disposed so as to give the greatest measure of protection to the vital parts. Her motive power consists of two sets of vertical inverted direct acting triple-expansion engines with cylinders 15 in., 25 in., and 34 in. diameter, and a stroke of 24 in., whilst the necessary steam is supplied by two boilers 18 ft. 6 in. long, and 9 ft. diameter, and having a heating surface of 4,600 square feet. The vessel carries at normal draught 125 tons of coal, but she has a bunker capacity for 250 tons, which, at 10 knot speed, will give her an effective radius of action of 4,670 knots, and an endurance of 19 days. The battery or armament of the *Castine*, which is the most powerful ever placed on a boat of her class, consists of 8 4-inch 33-pounders, 4 6-pounders, and 2 1-pounders, R.F.G., 2 Gatlings and one fixed torpedo discharge tube in the stem. The ship's complement will consist of 29 officers, 129 sailors, and 10 marines, and the crew's accommodation forward is spacious, well lighted, and ventilated. The *Castine* was especially designed for service in the China seas, and, with its small length, light draught, and great offensive and defensive powers, it will certainly prove a very valuable addition to the new U.S. Navy in that quarter. Her sister ship, the *Machias*, is now in commission, and, in the construction of these two gunboats the Bath Ironworks have fully upheld their reputation, earning for themselves in excess speed premiums the handsome sums of 60,000 dols. on the *Castine*, with 16·032 knots, and 45,000 dols. on the *Machias*, with 15·464.

Modestia.—On September 16th the new cargo and passenger steamer *Modestia*, built by the Flensburg Shipbuilding Co. for the Hamburg Pacific Line, was taken on her trial trip. The dimensions are:—336 ft., by 42 ft., by 28 ft. The triple-expansion engines of 1,600 H.P., also built by the Flensburg Shipbuilding Co., worked on the trial to great satisfaction, and gave the vessel an average speed of 12¼ knots. The Flensburg Shipbuilding Co. held their general meeting on the 30th September, and declared to the shareholders that a dividend of 14 per cent. would be given for this year.

Appomattox.—On September 24th the s.s. *Appomattox*, the first of three cattle boats which Messrs. Furness, Withy, & Co. have on order for the Chesapeake and Ohio Steamship Co., proceeded from the Hartlepools for the official steam trials. A considerable amount of interest has been taken in the construction of these ships, as they are somewhat different from the ordinary cargo boat usually launched from the Middleton shipyard, being adapted for a high rate of speed, and being fitted out in a most efficient manner for the North Atlantic cattle trade. The machinery has been constructed by Messrs. T. Richardson & Sons, of Hartlepool Engine Works, the engines being on the triple-expansion principle and of massive design, suitable for the Atlantic trading. The cylinders are 28 in., 44 in., and 72 in. diameter, with a stroke of 4 ft., the high-pressure being fitted with a piston valve, and the intermediate and low-pressure with double-ported slides. A steam jacket is fitted to the high-pressure cylinder, which is also provided with a circulating receiver, arranged for drying the steam on its passage to the intermediate pressure engine. The drain from the high-pressure jacket is connected to Morison's evaporator, so that not only is the jacket kept free from water without the slightest trouble to the engineers in charge, but the additional circulation of steam in the jacket greatly increases its efficiency. The crank shaft is of Messrs. T. Richardson & Sons' well-known built type, in three interchangeable pieces, and is made of the highest class of ingot steel, considerably in excess of the requirements of the Board of Trade and Lloyd's. The cylinders are supported at the front by three heavy cast iron columns, each having a double base, so that the whole structure is unusually strong and well-suited to the requirements of the trade. The engine-room accessories are very complete, there being special duplex pumps and distilling apparatus for supplying the cattle with fresh water, whilst the installation of electric light, by Messrs. Clarke, Chapman, & Co., of Newcastle, is very effective. Steam is supplied by two large double-ended boilers, arranged for a pressure of 160lbs., and having twelve of Morison's suspension furnaces. The furnaces are fitted with Geddes's protector fire-doors. Another feature in connection with the boilers is Morison's circulating feet-heater apparatus, but one productive of valuable results. The entire machinery has been constructed under the personal superintendence of Mr. G. McFarlane, the consulting engineer of the company, and at the trial the various details were worked under his inspection, and were to his entire approval. The engines were in charge of Mr. Robinson, the outside manager for the firm, Mr. D. B. Morison, the general manager, being also present. After the adjustment of compasses, a trial of four hours was made, under the direction of Captain Manley, the marine superintendent of the company, and a speed of 13½ knots obtained, which was considered very satisfactory. Mr. Withy and Mr. Sivewright represented the builders, and they are to be congratulated on having completed one of the finest boats ever built in the Hartlepools.

Ormidale.—On September 26th the screw steamer *Ormidale*, built by Messrs. Workman, Clark & Co., Limited, Belfast, proceeded down Belfast Lough on her trial trip. The vessel has been built to the order of Messrs. R. & C. Allan, of Glasgow. The principal dimensions of the vessel are:—Length, 561 ft.; breadth, 44 ft. 3 in.,; depth, 29 ft. moulded, with a gross tonnage of 3,560, and deadweight capacity of 5,600 tons. She is built to Lloyd's 100 A1 class, and to the B.S. class of the British Corporation and is of the three deck type, with hoop bridge, and top-gallant forecastle decks, and cellular double bottom fore and aft for water ballast. The upper and main decks are of steel, and in addition the upper is sheathed with teak. Hold beams have been dispensed with, leaving the holds unobstructed for stowage of cargo. For the working of cargo a complete arrangement of winches and derricks has been fitted having two at the larger hatches. The holds are four in number with a large reserve bunker which can also be utilized for cargo, and worked by a steam winch. The bridge contains the saloon and accommodation for the captain and officers. The saloon being panelled in various shades of oak with walnut pilasters, and mouldings with sideboard and fittings to suit and upholstered with Utrecht velvet. The crew are housed in sidehouses under the forecastle deck. A complete system of electric lighting is introduced into the rooms, holds, machinery space, mast, and sidelights, the installation being supplied by Mr. W. C. Martin, of Glasgow. Two sets of steering gear are supplied, one of these being a steam gear, supplied by Messrs. Muir & Coldwell, and placed amidships in the engine casing and controlled from the pilot house on flying bridge, a powerful steam windlass with capstan overhead is placed forward under the forecastle deck. The *Ormidale* is rigged as a brigantine with topsail and topgallant yards on the fore mast. The machinery has been constructed at Messrs. Workman, Clark & Co.'s engine works, Queen's Road, and consists of triple's expansion engines of the most modern type, having cylinders of 25 in., 41 in. and 68 in. diameter, stroke 48 in. Steam is supplied from two large steel boilers at a working pressure of 180 lbs. These boilers are fitted with James Howden & Co.'s system of forced draught; a large donkey boiler, of steel with working pressure of 90 lbs., is placed in stokehold for supplying steam to winches and auxiliary engines. The propeller is of manganese bronze. After running the measured mile, on which an average speed of 13¼ knots was attained, the *Ormidale* cruised about the Lough for some time and then proceeded on her way to Cardiff to load for Cape Town.

Humberto Rodriguez.—On October 2nd a very powerful steel steam tug steamer, named the *Humberto Rodriguez*, left the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesbrough, for the purpose of testing the speed of the vessel and also the general working of the special machinery with which she has been fitted for the purposes of her trade. She has been built for Messrs. Hawkes, Somerville & Co., of Liverpool, representing Cuban owners, who were represented at the trial trip. Everything was found to work with the greatest satisfaction and the guaranteed speed of 12 knots was exceeded. The principal dimensions of the vessel are:—Length, 135 ft. 6 in.; beam, 24 ft. 6 in.; depth moulded, 14 ft. 6 in., and engines have been fitted by Messrs. Westgarth, English & Co., of Middlesbrough, the cylinders being 15½ in., 25 in. and 41 in., by 30 in. stroke, with a large steel boiler working at 160 lbs. pressure. The vessel has been built under Lloyd's special survey for their highest class. Handsome accommodation is provided forward for 12 passengers and the captain, officers and engineers are berthed aft, where a well-appointed mess-room is also fitted. The crew and firemen are also accommodated aft in well ventilated and comfortable quarters. A shade deck is fitted over the engine and boiler space and awnings all fore and aft. Steam steering gear is provided in a wheelhouse erected on the shade deck. The fore and after peaks are arranged as water ballast tanks and the vessel is rigged as a fore-and-aft schooner. After coaling she proceeded direct to West Indies.

Christabel.—The new steel steam yacht *Christabel*, built for Mr. A. C. Kennard, Falkirk Iron Co., from designs by Mr. G. L. Watson, left Messrs. D. & W. Henderson's yard on October 5th, and on October 6th, by the invitation of Mr. Kennard, a large number of the officials of the Falkirk Iron Co. joined her at Gourock for the opening cruise. The day was exceptionally fine, considering the advanced season of the year, and a most enjoyable day was spent sailing through the Kyles, &c. A substantial lunch and dinner were partaken of on board, and Mr. Kennard's health and success to the new yacht duly proposed and acknowledged.

Shenandoah.—On October 7th the s.s. *Shenandoah* made a very successful trial trip in the Firth. She is the second of three steamers built by Messrs. Alex. Stephen & Son, Linthouse, to the order of the Chesapeake and Ohio Steamship Co., Limited, of London, for their new line between Newport News and this country. The vessel is designed for carrying about 5,500 tons deadweight, and is specially fitted for cattle—of which she can take about 760. She is a sister ship to the *Rappahannock*, already fully described; and on trial on the measured mile made the same average speed (about 14 knots), the machinery working with great smoothness, and without requiring any water whatever for bearings. The weather being bright and clear, the trip was exceedingly pleasant, and it was much enjoyed by, among others, C. Furness, Esq., M.P., the Chairman of the Chesapeake and Ohio Co.; Colin J. MacKenzie, Esq., Lord Lieutenant of Peeblesshire; Mrs. MacKenzie, John Glynn, Esq., Liverpool; Capt. Manley and Mr. Geo. McFarlane, superintendents for the owners; J. Bruce Murray Esq., Glasgow, and members of the builders' firm. After dinner Mr. John Stephen, who presided, proposed success to the *Shenandoah* and her owners, dwelling on the magnificent resources of the territory naturally trading through Newport News, the enterprises of the company, and the pleasure his firm had in building vessels which he hoped would prove serviceable to them in encouraging and developing the trade between their port and this country. Mr. Furness

replied, expressing his satisfaction with the boat, and speaking eulogistically of the Messrs. Stephen, of whom he remarked that he was confident they would honourably carry out an order to build although there were no specification at all to bind them. Mr. MacKenzie proposed the health of the builders, and other toasts followed.

Catchfaen.—On October 9th the screw steamer *Catchfaen* went on her trial on the measured mile at Skelmorlie, when she attained a speed at the rate of 10½ knots per hour. This vessel was built by the Ailsa Shipbuilding Co., of Troon, for Messrs. Kneeshaw, Lupton & Co., of Liverpool, for their limestone trade, and the following are her dimensions:—Length, 160 ft.; breadth, 24½ ft.; and moulded depth, 11 ft. 9 in.; and she has been fitted by the builders with compound surface-condensing engines, 20 in. and 40 in. cylinders by 27 in. stroke. This result was considered very satisfactory by Mr. Lupton, who attended for the owners, and Mr. Wm. Robertson and Captain M'Pherson, under whose superintendence the vessel was built and fitted out.

Turret Age.—The steamer *Turret Age*, the second vessel of the turret type designed and built by Messrs. W. Doxford & Sons, of Pallion, Sunderland, for the firm of Messrs. Petersen, Tate, & Co., of Newcastle, went on her trial trip from the Wear. On the 9th October she left the New Loch, South Docks, at half-past twelve, her departure exciting very great interest. A party of gentlemen, including Captain Petersen and Mr. Arthur Tate, the owners; Mr. W. Theo. Doxford, Mr. Chas. Doxford, and Mr. Robert Doxford, representing the builders; Mr. Temperley, shipowner, London; Mr. Furneaux (managing director Messrs. Clark, Chapman, & Co., of Gateshead); Mr. Keenlyside, jun., Blyth; Mr. Thomas Clifton, Mr. Fothergill, Mr. Alex. Grey, inspecting engineer for Messrs. Petersen, Tate, & Co.; Mr. Garniss, of Hull; Captain John Tate, commander of the *Turret Age*, &c., were on board. The *Turret Age*, it may be remembered, was described pretty fully in our September number after it was launched. The principal feature of this class of vessel is, as is pretty generally known, the raised platform which runs from end to end of the vessel, and which is 12 ft. above the water line. This platform forms a trunk way, which in cases were bulk cargoes are carried serves as a feeder, and thereby makes the possibility of the cargo shifting practically impossible under any circumstances. In addition, so well are the sides protected, taken together with the height from the sea level, it is almost an impossibility for any man to be washed overboard. When the turret ship was first invented its peculiar appearance led many people to the erroneous impression that it was a dangerous departure from the ordinary run of ships. This fallacy has been entirely disposed of. In fact, its particular build makes it more safe than the usual class of ships. Its safety is enormously contributed to by the elevated platform, as all the deck openings are situate thereon. When it is mentioned that the majority of well-deck vessels go to sea with the maindeck only fifteen inches out of the water the advantage of a steamer built on the lines of the *Turret Age* will be apparent. The owners of the vessel have shown considerable pluck and manifest shrewdness in solving the problem of an eminently safe ship with the highest possible carrying capacity for register tonnage. The accommodation for officers and crew—a very important item in the building of ships nowadays—is of the most excellent character, and can hardly be equalled by some of the finest passenger vessels. The crew have most comfortable quarters in the forecastle, and each engineer and officer has a separate berth. Mr. Charles Doxford, in fact, in designing the *Turret Age* had given great thought to the most minute detail, with the result that a vessel has been turned out which reflects the greatest credit upon the builders. The steering gear is of an improved type, manufactured by Messrs. Clark, Chapman & Co., after the designs of Mr. F. J. Pilcher, of Liverpool, the special feature being the application of buffer springs to relieve the gear from the shock of the sea striking the rudder. The vessel is also fitted with one of Mr. Joseph Temperley's patent cargo transporters, which have recently proved a marked success in dealing with heavy quantities of cargo in a most expeditous manner, and ensuring the utmost freedom from damage or breakages. Similar transporters were used during the last autumn manœuvres of the fleet, and proved of the utmost efficiency in enabling the rapid coaling of the warships to be carried out without danger to life or damage either to the collier or warship during the coaling operations in open roadsteads. The engines are of the triple-expansion surface condensing compound type, and the cylinders are 25 H.P., 37 I.P., 60 L.P., with 42 stroke, and have been built and fitted by Messrs. Doxford under the superintendence of Mr. Alexander Grey, Messrs. Peterson and Tate's inspecting engineer. One of the features of the engine room, which is commodious and well ventilated, is the See's patent hydraulic ash ejector with which it is fitted. By this ejector the ashes accumulated during a watch are literally washed overboard by the water from a pump in the engine-room, saving by this method the tiresome and dusty method usually in vogue. The *Turret Age* is of 1,383 net register tons, and 2,231 gross tonnage. She carries 3,700 tons on a draught of 19 ft. In fact, one of the chief features of the vessel is the low net tonnage and low Suez Canal registered tonnage compared with the deadweight carried, which means a considerable saving to the owners. Although the weather was very thick and showery at the start, it afterwards cleared up, and a most enjoyable run to Blyth was experienced. The measured mile was twice run, and the engines went well and smoothly, giving every satisfaction to the builders and owners of the vessel alike. The speed attained averaged 11¾ knots. At half-past seven o'clock the *Turret Age* ran into Blyth harbour, and the people on the piers and the seamen on the other vessels in the harbour were quite surprised at the fine appearance she presented.

Prince.—On October 10th Messrs. Napier & Son, of Cross House, Southampton, took a new vessel they have just constructed on the measured mile at Stokes Bay. She is named the *Prince*, and has a certificate to carry 189 passengers on the ferry service. She is an addition to the fleet of the Gosport and Portsea Waterman's Steam Launch Co. Her length between perpendiculars is 66·6 ft.; over all, 70 ft.; beam, 16 ft.; depth, 6·9 ft.; tonnage, B.M., 77 45-94ths; engines, 10 in. and 20 in. by 12-in. stroke; boiler pressure, 128 lbs. Her speed averaged in four runs 9·27.

Asturian Prince.—On October 12th the fine steel screw steamship *Asturian Prince*, built by Messrs. John Readhead & Sons, West Docks, South Shields, had her trial trip off the Tyne. The vessel is owned by the Prince Steam Shipping Co., Limited, Newcastle, Mr. James Knott being managing director, and is of the following dimensions:—Length, 340 ft.; breadth, 42 ft.; depth, 28 ft. 9 in., and classed 100 A1 at Lloyd's. She is of the spar-deck type. The vessel is intended for the Prince Line of steamships trading to South America, and the arrangements have been specially designed to suit this particular trade. The engines, also built by Messrs. John Readhead & Sons, are of the triple-expansion type, having cylinders 24 in., 40 in., and 66 in. by 45 in. stroke, steam being supplied by two large steam boilers working at a pressure of 160 lbs. per square inch. After compasses had been adjusted the vessel steamed north and south, her speed, &c., being thoroughly tested over the measured mile, about 12¾ knots being attained. The engines worked admirably, the trial being highly successful and satisfactory to all concerned, and quite up to the anticipations of both owners and builders.

Zaire.—On Thursday, October 12th, the s.s. *Zaire* left the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesbrough, for her official trial trip. Everything worked in a most satisfactory manner, and on the measured mile a speed of 14½ knots was attained. This vessel has been built to the order of the Empreza National Steam Navigation Co., of Lisbon, under the superintendence of T. C. Laws, Esq., of Liverpool, the English representative of the company. She is built to Lloyd's highest class, the principal dimensions being:—Length, 350 ft. 6 in.; beam, 42 ft. 2 in.; depth, moulded, 28 ft. 9 in. Accommodation is fitted for about 250 passengers, fitted up on the main deck, together with rooms for mails, plate, linen, baggage, &c., &c. The first-class dining-saloon is a spacious apartment, very handsomely panelled with marble in a variety of colours, and elaborately panelled and carved walnut dado. The smoking-room is on the promenade deck, and is also of marble, the woodwork being of oak. The entrance to the cabin is of elegant design, and is also of marble with oak parquet floor. The upholstery is of the most luxurious description, every arrangement which can conduce to the comfort of passengers at sea being liberally provided, including a very fine piano. At the after end of the dining-saloon the servants' rooms, lavatories, bath-rooms, &c., for the first-class passengers are fitted. The second-class accommodation is amidships, and is panelled throughout in polished hardwoods, the saloon panelling being of fancy woods in various designs. The third-class accommodation is forward, and is of the most comfortable

description. Bath-rooms are provided for all class of passengers and for the crew. The officers and engineers are berthed in a long bridge-house on the upper deck amidships, and there is also fitted up the hospital, chart-room, bakery, fruit and vegetable rooms, &c. The captain's room is on the top of this bridge-house, and is handsomely fitted up. This room adjoins the wheel-house in which steam steering gear is fitted. The petty officers and crew are berthed in the topgallant forecastle. The large galley is fitted with cooking apparatus of special design, including large baker's ovens and jacketted steam boilers. The vessel is lighted throughout with electricity, over 300 lamps being provided. Stone's pivotted side-lights are fitted. also folding berths, tip-up lavatories, &c. The vessel carries a large steam launch, which is lowered by Allan & Co.'s patent Davits, and the lifeboats are the Seamless Steel Boat Co.'s patent, being made of steel without seams. Machinery has been fitted by the Pulsometer Engineering Co. for the manufacture of ice, which is then stored in a specially insulated room until required for use. The upper deck is of steel sheathed with teak, and the main-deck is of steel sheathed with yellow pine. Water ballast is fitted in cellular double bottom, and also in deep tank aft, and the latter is fitted for use as a magazine when not carrying water ballast.

Iurua.—On October 13th the new Brazilian steamer *Iurua*, built by Messrs. Murdoch & Murray, Port-Glasgow, and engined by Messrs. Kincaid & Co., Limited, Greenock, to the order of Jose R. de Olivera, for the navigation of the River Amazon, made a successful trial trip in the Firth of Clyde, when a speed of 10½ knots was attained under easy circumstances. This vessel, which is a twin-screw, has been specially built and arranged for carrying passengers and cargo in a tropical climate, and leaves as soon as the quarantine regulations in Brazil will permit.

Cayo Mono.—On Saturday afternoon, October 14th, the new steamer, *Cayo Mono*, built by Messrs. C. S. Swan & Hunter, shipbuilders, Wallsend, to the order of Messrs. Ernest Bigland & Co., London, left the Tyne to test her machinery over the measured mile off Tynemouth. The *Cayo Mono* is a fine type of the modern passenger and cargo steamer combined, her length over all being 326 ft., with a beam of 41 ft., and a moulded depth of 26 ft. 10 in. Her water ballast arrangement is on the cellular double bottom principle, with six watertight bulkheads. Her frames are extra strong amidships, and hold beams and webs have consequently been dispensed with. In her deck machinery and general get up, all the latest improvements in naval architecture have been introduced with success. The craft was constructed under special survey, and she has been assigned the highest class at Lloyd's. Her engines were built by Messrs. Thomas Richardson & Sons, of Hartlepool, the dimensions of her cylinders being 24 in., 38 in., and 64 in., with a stroke of 42 in. At the trial trip on Saturday, the builders were represented by Mr. G. B. Hunter, managing partner for the firm, engine builders by Mr. Robinson, and the owners by Mr. Bigland. During construction the vessel has been specially superintended by Mr. H. Barringer, N.A., of London, and his assistant, Mr. Bradney. The trial proved a most satisfactory one, a speed of over 12 knots being obtained in a series of runs, the machinery working smoothly and without perceptible vibration. The vessel proceeded to London the same evening to complete her outward cargo.

David Mainland.—This vessel, whose dimensions are given in our Launch accounts this month, went on a most successful trial trip on Monday, the 16th October. She was built by Messrs. Wm. Gray & Co., Limited, and forms the latest addition to the fleet of Messrs. John Coverdale & Son, of West Hartlepool. The machinery was provided by the Central Engine Works, and the vessel is the fourth for the same owners which has been fitted with triple engines from the same works. The weather on Monday was of the most favourable character, and the occasion was graced by the presence of several ladies, amongst whom were Mrs. Coverdale, Mrs. Hill, Mrs. Cooper, Mrs. Sanderson, Miss Coverdale, and Miss Andrews. There were also present a number of gentlemen interested in the vessel's performance, viz., Mr. R. Coverdale (owner), Mr. James Airey, under whose superintendance the engines and boilers have been constructed, Mr. ...per, Mr. Butterwick, Mr. Arthur Hill, Rev. E. R. Ormsby, ...Sanderson, Mr. Blackie (Lloyd's engineer surveyor), and ...r. Mudd, of the Central Engine Works. The vessel had been out in the early morning adjusting compasses, and as soon as the trial trip party arrived on board she was got under way and the engines were run steadily full speed ahead without intermission at 78 revolutions per minute for over two hours, the speed of the ship being found to be over 11½ knots per hour, the vessel being partially light. The boilers were quite steam-tight, a full head of steam was maintained easily, and no hitch or difficulty of any kind occurred in the machinery, all bearings running cool without the application of water. The smooth, quiet running of the engines, and the absence of vibration in the ship were features of the trial noted by all on board. This vessel is fitted with many specialities adopted by the builders of the machinery, all designed with a view either to lengthen the life of the several parts, or to reduce the consumption of fuel. As an example of the former, we may mention a simple expedient devised by Mr. Mudd for lengthening the life of tail shafts, described and illustrated in our June number for this year. In ordinary practice the central part of the shaft bears upon nothing, but is constantly exposed to the action of sea water. The rapidity with which this destroys the shaft at a part where it cannot be seen when at work is matter of common knowledge, and many attempts have been made to overcome it. This appears now to have been accomplished in the *David Mainland* and a number of other steamers by encasing the part affected in an elastic sleeve which clings to the shaft and its brass liners, and effectually keeps out the water. An example of the other kind is the Mudd and Airey metallic packing, which is fitted to all the piston rods and valve spindles and to the feed pumps of the *David Mainland*. This packing has been gradually brought to a state of great perfection, and is a more important detail than would at first sight be guessed. It is not generally recognised that a high-pressure gland packed with ordinary soft packing has to be nipped up so much that the grip upon say a 6-in. rod requires about 50 H.P. to thrust the rod through the packing at the ordinary rate of speed. By the use of the metallic packing here referred to, not only is the power thus expended in friction entirely relieved and sent to the propeller to assist in driving the ship, but the destruction of the piston rods and spindles which it entails is also overcome, and practically no wear is experienced over long periods of running. On the trial trip the whole of these packings were running in an entirely satisfactory manner, and it is certain the spirited policy of the owners of the *David Mainland* in adopting these various improved details will result in the vessel proving one of the most efficient and economical steamers of her class. A very good luncheon was served by Mr. Squires, of the Raglan Hotel, at which appropriate toasts were duly proposed and honoured.

Bullmouth.—On October 18th this vessel, which is the sixth of the large oil boats built by Messrs. William Gray & Co., Limited, for Messrs. M. Samuel & Co., Limited, of London, went on her trial trip off Hartlepool, when a very satisfactory run was made with this vessel, as with her predecessors. These vessels have occasioned a large amount of interest in the shipping world, not only through their being the first group to carry oil in bulk through the Suez Canal to the East, but also because they are fitted up in such a way as readily to be able to clear their holds from the effects of the oil and carry ordinary cargo home from the East just like an ordinary ship. Her dimensions are:—Length over all, 358 ft.; breadth, extreme, 45 ft. 6 in.; depth, 28 ft. 6 in.; and her engines and boilers, which are fitted in the after part of the vessel, are of the well-known type manufactured at the Central Marine Engine Works. The cylinders are 26 in. 42 in. and 70 in. in diameter respectively, and the stroke of all the pistons is 45 in. An extra amount of boiler power is provided in the shape of three large single-ended boilers working 160 lbs. pressure. On the trial trip most of the vessel's oil tanks were filled with water, so that she was well down, and in this condition she made an average of 10½ knots per hour, with the engine running easily at about 60 revolutions per minute. There were on board Captain Coundon, representing Messrs. Samuel & Co.; Mr. Baggallay, representing the inspecting engineers, Messrs. Flannery, Baggallay & Johnson, of London, under whose superintendence the vessel has been built; Captain Scott, the commander; and several visitors. The experts expressed themselves not only highly satisfied with the *Bullmouth* and her machinery, but also with the whole of the five previous ships in their practical work at sea over the many months they have now been at work. The vessels are admitted to suit admirably the special conditions they were designed to fulfil. It may interest some of our readers to learn that the

Bullmouth carries about 5,000 tons of oil in her holds in bulk from Batoum to the East, and that her sister, ship the *Elax*, arrived a little more than a month ago at Yokohama, in Japan, with her first cargo of oil, news of her having reached West Hartlepool, the opposite way round the world, viz. *via* Vancouver and the American route.

Maggie Bain.—On October 21st the s.s. *Maggie Bain*, belonging to Captain Niven, of Pollokshields, went on her trial trip in the Firth of Clyde. This vessel, which has just left the works of the Ailsa Shipbuilding Co., Troon, has been fitted with a new set of compound engines, 17½ in. and 40 in. cylinders by 27 in. stroke, by Messrs. Muir & Houston. The engines worked with remarkable smoothness, and the mean speed of a number of runs on the measured mile was 9½ knots fully loaded, which was considered highly satisfactory.

Annandale.—The new steamer *Annandale*, built and engined by Messrs. J. G. Rennoldson & Son, of South Shields, to the order of Messrs. William Reed & Son, of North Shields, has had her trial trip, which proved very satisfactory to her owners and builders. She is an iron paddle vessel with a surface-condensing engine of 50 H.P., fitted with the latest improvements for trawl fishing and general towing purposes.

Reviews.

Transactions of the Institution of Naval Architects. Vol. xxxiv. Edited by George Holmes, Secretary. London: Henry Sotheran & Co. 1893.

THE annual publication of this society contains the report, inaugural address, papers and accounts which were read to the meeting held in London at the end of March in the present year. We have reprinted with illustrations in our pages some of the most interesting and important of the contributions. The session is memorable in the history of the Institution from the fact that it saw the retirement of the second President—Lord Ravensworth, who has so ably fulfilled his duties. He is succeeded by Lord Brassey. His farewell address was unfortunately a record to some extent of heavy losses sustained by the society through the death of members. No less than fourteen of the body had joined the silent majority since the publication of the last report. One of the most interesting papers is that of the President-elect. He dealt with the important question of maintaining a sufficient reserve of merchant cruisers for use in war time. He told us how necessary such a reserve is, how much that necessity is appreciated by foreign nations (who pay lavish bounties to encourage the construction of vessels suitable for war purposes), and he urged our authorities to do what French, German, Italian and Russian Naval administrations are doing, and extend our resources in this direction. He pointed out how a comparatively small expenditure gives a very large assistance in this way. He did not go into figures, but we may say that for one vessel built we may get fifty subsidised cruisers. Nay, we can do more. For the naval ship has to be maintained and kept in the highest state of efficiency during the years of peace. The crew have to be fed, the coal bill has to be paid. The repairs and renewals have to be made good out of the public purse, and these are heavy items now that warships discover uncharted rocks with such monotonous regularity. In the case of merchant cruisers all these charges are borne by the shipowner. This is a considerable additional saving. Yet it is scarcely creditable that immediately after the publication of this paper, when the Admiralty did touch the questions of armed cruisers, their action was directed to the subtraction, and not to the addition of vessels. We had lost the "call" of the *Paris* and the *New York*, they have gone under another and a foreign flag, but the *Lucania* and the *Campania* were coming on, and would make up for this defection, giving us better ships, and making the total right. These ships were accordingly built to Admiralty requirements at a cost of many thousands of pounds, and were accepted by the Admiralty, who straightway told their enterprising owners that as they came in, the services of the *Etruria* and *Umbria* would be dispensed with, thus the Cunard line expended this money to disqualify their own ships, and the loss of the two American Liners is not made up. What encouragement is there here to patriotism?

The Institution can do us good service in the future. The whole question of battleship construction is thrown into the debatable land by the *Victoria* disaster. We must build the *Magnificent* and the *Majestic* whilst the debate goes on to strengthen our fleet, but we must lose no time in determining whether our whole theory of battleship construction is not based on error. If it be we are right for the present, other nations are involved in the same fallacies. We can build faster than they. But the lesson so dearly purchased must have all its teaching taken to heart. For this reason Dr. Elgar's paper on bulkheads is particularly worthy of our attention. Whatever may be done we hope that the authorities of the Institution will not aid the Admiralty in their attempt to stifle enquiry into this lamentable catastrophe. Captian James Kiddle, R.N., contributed a paper on a subject which needs ventilation. The future alone can tell us what will happen to warships in war time. How many of these complex machines, which cannot go through peace manœuvres without disaster, would survive to need repair, is a question at present unanswerable. But it is certain that our dockyard accommodation after a great naval conflict, now that repairs take months to execute, would be strained to its utmost limits, if it were not absolutely insufficient. Any aid to the wounded monster on its way to port, any power to prolong its usefulness whilst already repaired, would be most welcome. Yet the importance of his paper did not save this gentleman from a very curt reply from Sir Nathaniel Barnaby who told him that, as naval architects, they took no interest whatever in the paper. We here make bold to differ very widely from Sir Nathaniel. When naval architects can make vessels whose bulkheads shall be able to fulfil the professions made on their behalf, when battleships have stability to allow of compartments being flooded without the ship turning turtle, then perhaps these matters may be outside their purview. But as long as ships are designed which do not fulfil expectation, so long will designers do well to receive in silence and with gratitude the suggestions of practial men who propose to supplement the imperfect work of the office and the model room.

Catalogue of Mathematical and Surveying Instruments. W. F. Stanley, Holborn, London.

THE new catalogue just issued by this well-known instrument manufacturer comprises over 3,000 articles for every use in office and field, as far as known by the engineer, architect and draughtsman, from the most expensive theodolite to a drawing pin, and therefore forms a very useful and complete compendium of instruments to be included in the office or library of a professional man. The value of this book is further increased by the notes and recommendations that are included in the descriptions of the article in many cases. Further, the catalogue is evidence of the vast improvement that has been made within the last ten years in the construction of mathematical instruments of all kinds.

The Principles of Fitting. By a Foreman Patternmaker. London: Whittaker & Co. 1893.

ANOTHER book from this author is sure to find a welcome from the practical engineer, especially when it treats of so important and universal a subject as "fitting." The subject is a very wide one, and it must have been a difficult thing to lay down a scheme of treatment. Difficult or not, our author has succeeded admirably. He begins with an account of the tools and materials, and then gives a chapter on "methods of union." This includes bolts, studs, cottars, and such like. The various places for which each is best adapted, and the elementary treatment of the material into which they are to be inserted is excellently shown. Then follow chapters on lining out, on chipping and filing, and on adjustment. The method of handling heavy blocks of metal is dealt with under the head of "slinging and lifting," whilst repairs have a chapter to themselves, and hints on joints, packing, and friction conclude the body of the book. Some useful rules are included in an appendix, and we may almost say that with such a book to study the pupil could turn out small engines without supervision. The "almost" qualification is necessary, not because of any shortcoming in the author, but because there is no royal road to fitting any more than to any other art. They must all be learnt laboriously, and patience and accuracy of work—two things the most necessary to the successful fitter—cannot be learnt save by the usual passage through the mill. Nevertheless, such a book is likely to be useful to all engineering students. There is one remark in the introduction which

we cordially endorse. To this we would call special attention. It is to the effect that big shops where work is specialised are not the best places to learn engine-fitting. The general shop in the country, where work of all kinds comes in, where repairs have to be extemporised and hurriedly devised, are the places to acquire a thorough knowledge of the business and that resourceful habit of mind which is so important to the successful engineer. We must not forget to note that the book is thoroughly illustrated.

Machine Drawing for the use of Students in Science and Technical Schools and Colleges. By Thos. Jones and T. G. Jones; published by the authors, 1893.

THIS work is the joint production of a master in a higher grade Board School, who is also a mechanical engineer, and of a Whitworth scholar. It is intended to give to the student a book on machine drawing which would furnish, at a reasonable price, properly finished and complete drawings of details taken from the most recent practice. As the book is published at 3s. in limp cloth, the price is certainly reasonable. A glance through the forty quarto plates will soon satisfy the critic that the aim of providing modern drawings properly finished is fully attained. But we cannot let our criticism rest here. There is a large amount of letterpress furnished on the pages opposite to the plates. This gives a lucid explanation of the drawings, whilst questions, exercises, and hints are also given as well as a few formulæ. The whole is certainly likely to make a student not only execute good drawings, but also appreciate the machinery he is graphically describing.

Marine Boiler Management and Construction. by C. E. Stromeyer. London: Longmans, Green & Co., 1893. Price 18s. net.

THE author of this work is a thoroughly practical man. Amongst other qualifications he is a surveyor to Lloyd's at Glasgow, and various learned societies, whose *raison d'etre* is the study of naval and mechanical problems, contribute to the letters which he is entitled to append to his name. As might be expected then, the work is of a very thorough nature. Indeed, one has only to look at the list of publications referred to to see that British, foreign and American literature has been ransacked for material.

Though the work treats of boiler construction and management from the highest and most scientific standpoint, the elementary duties of the boiler cleaner and the fireman are not neglected, and the best methods of performing their simple operations are discussed. A man with Mr. Stromeyer's experience must be the first to see that the utmost technical knowledge in the chief engineer's cabin, and the best design and workmanship will be useless if there is careless firing in the stokehold.

The chapters on boiler construction include a description of the shop machinery used in the manufacture, and full tables as to the strength of materials and the necessary thickness of plates and the size of stays, etc., are afforded. There are important remarks on the subject of corrosion and on heat transmission. The perusal of these is likely to give some fresh idea to the marine engineer, and the suggestions contained are calculated to prolong the life of the machinery in his charge.

Throughout the book is very fully illustrated and the cuts are well designed for the purpose of explaining the letter-press. As a whole we must conclude that the work is the most thorough and scientific of the many on this subject that have come under our notice.

Edwards's Nine-hundred Examination Questions and Answers for Engineers and Firemen. Philadelphia: H. C. Baird & Co.; London: E. & F. N. Spon. 1893.

IN the States every one in charge of steam machinery has to get a government certificate before entering on his duties. The examination is not a very severe one, but it is sufficient to test the intelligence of the workman, and to prove the fact of his having some elementary knowledge of the principles and practice of the steam engine. The present volume is intended as a coach for candidates for this examination. It therefore attempts, in popular language, to explain the machinery itself, and to tell the candidate why things are as they are, and to teach him what he ought to do under various circumstances that are likely to arise in the course of his work.

Whether the same law will be passed in this country remains to be seen. Possibly the accidents which occur from time to time to stationary engines and agricultural machinery might be avoided if the education of the attendants were compulsory by law. On the other hand it is an old theory, unfortunately not much in favour at present, that the State should not take such responsibilities on itself, but leave the full duty on private persons to see to the fitness for their employment of their servants whom they put in responsible situations. Whether therefore the compulsion for a workman to understand the nature of his duties arises in one way or the other the use of such a book as the present is undoubted. It has had a remarkable circulation in America and it should have the same here, for it fulfils its aim admirably.

Artillery: Its Progress and Present Position. By E. W. Lloyd, R.N., and A. G. Hadcock, R.A. Portsmouth: J. Griffin & Co. 1893.

To the marine engineer and the shipbuilder the interest and importance of this volume can hardly be over-estimated. We do not mean to suggest that the management or working of artillery is ever likely to come within the duty of either of these classes of readers. But at the same time it is obvious that a knowledge of the progress and present position of the guns, for the carriage of which warships chiefly exist, is a matter which cannot fail to interest every one of our readers. And a knowledge of their peculiarities enables the engineer to better understand his part of the duty concerning them, viz., the use and requirements of the hydraulic machinery for working them, and the shipbuilder must have knowledge of the same kind for his work in construction and design.

There are probably no persons who have had greater opportunity for amassing the knowledge to enable them to treat of the present subject than have the present authors. They have by no means wasted their opportunities. They have given us a well-written and interesting volume. They evidently are not affected with any mock modesty, and do not depreciate the undoubted pre-eminence of their own firm in these matters, which it has made peculiarly its own. But at the same time they are ready and anxious to do justice to Woolwich at home, and to Krupp, Canet, and Gruson abroad.

There is one remark early in the volume which, though literally true in the sense in which the writers use it, is apt to make the reader who has completed the perusal of the volume make a rather doubtful comment as he recollects it. It is at page 87, and is as follows: "It must be borne in mind that a gun is only a simple engine." After reading this book and realizing the immense thought required in the design, selection of material, construction, mounting, choice of ammunition, disposal of reserve of shot and powder, in loading and training the weapon when complete, one might well exclaim, "if this be a simple engine what must a complicated one be?"

The work is eminently readable, and is the outcome of very careful work. The number of cross references given is very unusual, and exceedingly pleasant to the reader. Throughout it is well illustrated, and the illustrations are well executed. The historical part of the subject has proper attention, and the line between ancient and modern artillery is fixed at the Crimean War. It is a strange but undoubted fact that though guns had been known so many centuries they were not much developed from their original form until some forty years ago. Then began the battle between guns and armour, and size and cost advanced continuously. Now a halt is called in increase of size and attention seems diverted to ammunition.

The first part of the book is chiefly descriptive, the really scientific part being reserved for separate treatment. Here we find the science of gun-making discussed in so far as its formulæ differ from those usually employed by engineers. The heads are subdivided into those relating to interior and exterior ballistics and to the strength of the gun. The subject of the action of the powder gases on the projectile in the interior of the gun is what is meant by interior ballistics, and though Robins published the result of his researches on the point in the "New Principles of Gunnery" in 1742, it has been within the last quarter of a century that the present series of researches, to which we owe all our knowledge on the subject, were commenced by Sir Frederick Abel and Captain Noble. An interesting account of the apparatus they used (an apparatus which is designed to show the action of the powder under conditions as nearly as possible approximating those prevailing inside a gun itself) is furnished. In their account of the researches into the question of external ballistics—which are the experiences of the projectile as regards

the forces it is subjected to after leaving the gun, but before striking the object aimed at—there are most readable accounts of the theory of the ballastic pendulum, of Robins' whirling machine, and of Bashford's chronograph.

Generally it will be found that the authors have furnished us with a very complete record of the history and present position of the science. What the future may bring we cannot forecast when we regard the rapid advance of previous years. The most noticeable improvements of very recent times seem to have been in the accessories, and we believe that the disappearing gun has before it a very great future. The length of modern ordinance seems to forbid the introduction of this system of mounting on ship board, though in former times we believe it was introduced with success for the shorter guns then prevailing. If the system could by any means be adopted for warships we might find it a great help towards the solution of many of the difficulties which beset the shipbuilder. But on this point the authors maintain a discreet silence. They give us full particulars about the present, and wisely leave the future to speak for itself.

Correspondence.

[It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—Ed. M. E.]

ACCOMMODATION FOR THE CREW.

To the Editor of The Marine Engineer.

Dear Sir,—While reading the accounts of launches and trial trips in your valuable paper, in which you give your readers elaborate descriptions of the ships, boilers, engines, saloon, captain's cabin, &c., detailing the various improvements that are adopted to render these departments effective and perfect, and which, as regards the two latter, frequently contain such items as "fitted up in bird's-eye maple," "folding washstands," "hand-painted by ladies staff of decorators," &c., &c., I have often thought that if you could supplement the above information with a few particulars as to the kind of accommodation provided for Jack Holystone and Tom Fire Bar, in the forecastle, and which might contain such items as if "a convenient table to eat from," if "comfortable seats and lockers," if any "convenience for ablutions," if "good lamps and looking glass," if "amply large enough for ——men," if "well ventilated and lighted," &c., it would, in my opinion, be productive of considerable improvement, as the difference of cost between a comfortable place for these hard wrought men to spend their time in when off duty, and the present (in too many instances) disgraceful style of throwing in a few bunks without even a table or lockers, would be very trifling. Proceeding with a description of the accommodation provided for the officers and engineers, the arrangements for whom often remind me of the following yarn. In a country, which a few years ago entered the comity of nations, the inhabitants considered themselves capable of building steamships, and accordingly built one and appointed a day for a trial trip, and the day arriving, steam was got up with a few coals which had been thrown into the stoke-hole for that purpose, when the authorities were informed that if the boat was to go outside the harbour a great deal more coal would be required, and on the question being gone into it was found that not only was there an insufficiency but there was no place to put coal, bunkers never having even been thought of. Now looking to the any hole and odd corner style of accommodation frequently met with, leads me to consider the two cases parallel, of course substituting officers and engineers and their quarters for coal and coal bunkers. Now, Sir, to give my reasons for believing that if you could favour your readers with these items it would be productive of considerable improvement. Firstly, there is no man, be he shipowner or builder, or even a superintendent captain or superintendent engineer, under whose inspection the ship is said to be built and fitted out, who is impervious to the desire of emulation, and who would like to be sandwiched between better described ships in the launch and trial trip accounts, and as it would be this latter which would influence them in refusing the any hole or odd corner business. I consider secondly, that as the Press is the great lever which will remove any evil that is removable, I desire to put the said lever into action by appealing to you, Sir, to make a move in the matter for the benefit of your numerous readers in this direction, and beg to remain, Sir, yours faithfully,

J. L.,
N. Y. K.

Yokohama.

Marine Engineers Examinations.—At the Board of Trade Examination held at North Shields on October 10th, 11th and 12th, Mr. Trowell, of Jarrow, succeeded in passing as extra first-class engineer. He was prepared by Mr. W. H. Thorn, 5, Waterville Terrace, North Shields, and passed the first time of going up, making the 22nd successful pupil for this grade from the above establishment.

Messrs. John Scott & Co., engineers and shipbuilders, Kinghorn, Fife, after having completed the removal of their engineering and boiler-making department from Kircaldy to their enlarged and modernised premises at Kinghorn, have had their name enrolled on the Admiralty List, and may now be called upon to tender for the construction of ships of all classes, with propelling machinery or boilers for same.

H.M.S. "Sultan."—The contract for the re-engining of the third-class battleship *Sultan* at Portsmouth, has been placed with Messrs. J. & G. Thomson, of the Clyde. The engines are to be of the triple-expansion type, and are to develop 6,500 H.P. with natural and 8,000 with forced draught.

The Manchester Ship Canal.—A new pontoon dock, capable of raising and docking vessels of 5,000 tons and 350 ft. long, was inaugurated at Ellesmere, a port on the Manchester Ship Canal, on October 18th. The first vessel to use it was the three-masted barque *Beeswing*, of Portmadoc.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from September 14th to October 11th, 1893.

17224 H. A. House, sen., H. A. House, jun., and R. R. Symon. Boilers.
17226 G. Lawrence, Constructing tubular coils.
17274 J. J. Meagher. Rowing boats.
17287 T. M. Houghton. Ship's rudder and gearing.
17293 H. C. Johnson. Tackle or pulley blocks.
17299 J. Bradshaw. Screw propeller for vessels.
17315 C. J. L. Hancock. Furnace bars, &c.
17326 A. McKinlay. Boat lowering, &c., gear.
17339 A. Brown. Automatic watertight doors.
17366 A. J. Boult. (H. Leineweber and A. J. Aubert, United States.) Torpedoes.
17384 M. Mœser and R. Erpel. Construction of dry docks.
17396 J. Fletcher. Funnels.
17399 A. Bolzani. Pulley blocks.
17402 C. M. Douglas. Folding boat.
17410 W. Hudson. (J. Shotton, Ottoman Empire.) Boiler tubes.
17452 H. Davey. Steam engines.
17473 J. W. Davis. Steam generators.
17479 F. Bacherts. Screw propellers.
17483 F. Nitschmann. Compasses.
17487 A. Tatzelt and A. Schöche. Boilers.
17494 H. Scholz. Water gauges.
17502 W. B. Maxfield. (J. H. Abbes, Germany.) Ship propellers.
17513 D. Whitehead and A. H. C. Gibson. Boiler furnaces.
17531 S. Diplock. Boiler covers.
17537 W. Lockwood. Actuating ship's bulkhead doors.
17548 W. M. Alexander. Steam engines.
17626 D. D. Esson and M. J. Davy. Propulsion of torpedoes.
17637 W. F. Beart. Stopping leaks in ships at sea.
17656 W. G. Wilson. Directors for torpedoes, &c.
17671 J. Barbour. (G. Rack, Germany.) Lubricating appliances.

17683 T. F. Walker. Ship log apparatus.
17696 E. A. Smith. Boat.
17698 L. Gimalaki. Propellers.
17710 H. J. Dabbs. Pipe joint.
17721 J. G. Statter. Driving of shafts.
17730 E. Elliott and W. H. Cocker. Preventing the racing of marine engines.
17742 G. G. Rhodes and T. Metcalfe. Reducing condensation in steam cylinders.
17748 E. Moffat. Preventing incrustation in boilers.
17765 H. Brandon. Packing for piston rods, &c.
17792 C. Page and L. Fortier. Propellers for vessels.
17815 J. Gresty and G. H. Herbert. Water tube steam boilers.
17849 E. Edwards. (R. Nadeniczek, Austria.) Rotary engines.
17852 A. Tost. Furnaces.
17861 J. Roots. Internal combustion engines.
17872 I. Ray. Pipe connections and flanges.
17885 W. P. Hoskins. Additions to ships' berths.
17892 J. Cran. Steam winches.
17893 F. J. and A. Bailey. Preparing lead pipes for jointing.
17926 E. Meyer. Folding boats.
17934 M. Hill. Ships.
17956 R. McKay. Steam generators.
17982 F. Schneider and C. Alder. Controlling feed-water.
17995 A. J. Boult. (J. M. Buisson, France.) Lubricators.
18014 L. J. Docker. Preventing scale in boilers.
18076 J. L. White and H. S. White. Steam boilers.
18087 A. Horne and J. B. Furneaux. Motors.
18105 W. D. Bohm and D. D. Esson. Torpedoes.
18152 J. Vaughan-Sherrin and C. N. Garner. Pistons.
18158 C. C. Braitewaite. Bearings.
18172 A. Bear. Stair treads.
18176 W. Bentley. Drilling and tapping machines.
18183 R. F. Mack. Preventing ships running on shore.
18200 J. Judge. Self-closing valves.
18207 R. Clucas. Screw propellers.
18234 J. A. F. Hall. Steering and stopping ships.
18241 J. McHardy and W. G. de F. Garland. Boats.
18282 P. A. M. Brunel. Vessel propelling apparatus.
18322 E. and A. W. Bennis. Furnace for boilers.
18364 W. Brookes. Lubricators.
18372 A. M. Pietri. Raising sunken vessels.
18394 W. M. Walters. Working of sailing ships.
18397 J. Richardson. Universal life preserver.
18518 F. N. Mackay. Packing devices for engines.
18599 J. W. Mackenzie. Steering vessels.
18607 J. Molas. Pumps.
18632 G. E. Belliss and A. Morcom. Steam engines.
18637 T. Downie. Packing of pistons and engines.
18686 J. Roper. Drilling and other machine vices.
18760 H. A. House, sen., H. A. House, jun., and R. R. Symon. Means of devices for raising anchors.
18775 B. H. Thwaite. Armour plates.
18845 A. J. Marquand. Protective coatings of iron and steel.
18881 E. Robin. Boat-hooking and disengaging gear.
18884 W. P. Thompson. Screw propellers.
18987 W. Dawson. Furnaces for steam boilers.
18993 I. E. Clifford. Torpedoes.
19025 W. Craig. Valve gear for direct-acting engines.

BOARD OF TRADE EXAMINATIONS.

EXTRA FIRST CLASS.

October 12th—Mr. Trowell—Ex 1C N. Shields.
„ 20th—A. Clark—Ex 1C Leith.
„ 20th—W. Irving—Ex 1C Plymouth.

NOTE.—1C, denotes First Class; 2C, Second Class.

September 23rd, 1893.

Aldroft, James A.	2C	Liverpool
Brooksbank, O. E.	1C	„
Cameron, A. J.	2C	London
Cawrse, Edwin	2C	N.Shields
·rbett, Arthur	2C	Liverpool
mmins, T. D.	1C	N.Shields
Duncan, D. ..	1C	London
Edgar, Henry..	1C	Liverpool
Foulkes, Fk. A.	1C	„
Gardner, T. McK.	2C	Glasgow
Gurelam, A. W.	1C	Cardiff
Henderson, D.	1C	Dundee
Jones, Charles..	2C	Liverpool
Jones, Thomas	1C	N.Shields
Krantz, A. T...	1C	Cardiff
Long, Wm. H.	1C	Liverpool
McLaren, R. B.	2C	Glasgow
Meldrum, J. ..	2C	London
Mellody, Andrew	1C	Liverpool
Nicoll, John A.	1C	Dundee
Parkes, John ..	2C	Liverpool
Pascoe, E. R. W.	2C	Cardiff
Ramsay, R. P.	2C	Glasgow
Rea, Alexander	2C	Hull
Robinson, R. W.	2C	Liverpool
Steele, Andrew	2C	Glasgow
Stewart, Robert	1C	„
Taylor, R. F. ..	1C	Cardiff
Thompson, T. L.	2C	Cork

September 30th, 1893.

Adams, W. R...	1C	Sunderl'd
Aiken, Andrew	2C	Aberdeen
Alexander, Wm.	2C	„
Bruce, George	2C	Liverpool
Burnett, J. E...	2C	N.Shields
Butterworth, J.	1C	Liverpool
Campbell, M. H.	2C	Aberdeen
Hicks, C. C. ..	2C	London
Hornigold, H. W.	2C	N.Shields
Hughes, W. P.	1C	Cardiff
Leslie, G. A. ..	1C	N.Shields
Lloyd, Edward	1C	London
Macqueen, Geo.	1C	Liverpool
Mankin, W. ..	2C	Sunderl'd
McCoy, T. L. ..	1C	N.Shields
McCulloch, D.	1C	London
Moore, S. H. ..	1C	„
Noble, William	2C	N.Shields
Ord, H. D. ..	2C	„
Paterson, A. B.	1C	Aberdeen
Rungeling, Th.	2C	Liverpool
Soppet, H. W.	2C	N.Shields
Taylor, Fk. G.	2C	Aberdeen
Thomas, L. ..	2C	Cardiff
Whitehead, Wm.	1C	Liverpool
Wright, James	1C	Aberdeen

October 7th, 1893.

Bapty, G. F. W.	1C	London
Bryan, R. H. ..	2C	N.Shields
Burt, David ..	2C	Glasgow
Caspers, C. J.	1C	N.Shields
Cullen, D. ..	1C	London
De Haan, J. H.	2C	„
Edington, Alex.	1C	Liverpool
Fadden, John..	1C	London
Galbraith, Hugh	2C	Glasgow
Gillison, D. W.	1C	„
Gunn, Herbert	2C	London
Heckels, D. S.	2C	N.Shields
Hendry, Jos. W.	2C	Liverpool
Houghton, S. A.	1C	London
Hunt, Charles..	2C	„
Kemp, Frank ..	1C	Liverpool
L'Estrange, A. H.	1C	Glasgow
Lonnon, H. ..	2C	London
McIver, Wm...	1C	Glasgow
Mitchell, Wm.	1C	„
Moon, W. H. ..	2C	„
Ord, Wm. ..	2C	N.Shields
Pellatt, Wm...	2C	London
Smith, H. F. ..	2C	Dover
Smith, James..	1C	Glasgow
Still, James H.	1C	London
Storey, John ..	1C	N.Shields
Taylor, Alex. E.	1C	Liverpool
Wallace, A. P.	1C	Glasgow
Watt, Thomas	2C	„
Wells, John G.	2C	Hull

October 14th, 1893.

Allan, A... ..	2C	London
Armstrong, T.	2C	N.Shields
Ashmore, G. H.	1C	Liverpool
Baker, W. C...	2C	London
Black, T. ..	1C	Dublin
Brodie, G. Wm.	1C	London
Brown, J. ..	1C	„
Burn, A. A. ..	1C	Cardiff
Clarke, Jos. ..	1C	London
Davis, J. B. ..	2C	Dublin
Deason, T. ..	1C	London
Flashman, Ed.	2C	Liverpool
Fletcher, H. T	2C	Greenock
Frost, Chas. H.	1C	Dublin
Hargreaves, S.	2C	Cardiff
Holland, M. F.	1C	Liverpool
Hutchinson, G. H.	2C	N.Shields
Jacques, T. G. L.	1C	Leith
Laing, W. R. ..	2C	„
Lees, R.	2C	Greenock
MacIntosh, M. W.	1C	„
Mackay, Chas.	1C	„
M'Gregor, D...	1C	„
Michelson, A...	2C	N.Shields
Munro, G. K. ..	1C	London
Paterson, W. M.	1C	Greenock
Philips, Wm. ..	2C	Leith
Robertshaw, H. L.	2C	Liverpool
Robertson, A...	2C	Greenock
Rockley, J. ..	1C	N.Shields
Selby, Johnson	2C	Cardiff
Sinclair, B. G.	2C	Liverpool
Sutherland, H.	2C	„
Thomas, D. J.	2C	Cardiff
Thompson, G.	1C	Dublin
Thompson, R.	2C	London
Wall, H. E. ..	2C	Cardiff
Watson, J. H.	1C	N.Shields
Whitcombe, W.	1C	Cardiff
Whyte, A. ..	2C	Leith
Williamson, R. D.	2C	„
Wright, Jas. ..	2C	Greenock
Young Jas. ..	2C	„

October 21st, 1893.

Arnott, W. J.	1C	Aberdeen
Batchelor, W. T.	2C	Hull
Dudgeon, J. ..	2C	Sunderl'd
Duguid, J. S...	1C	Aberdeen
Fry, F. C. ..	1C	N. Shields
Hamilton, A. J.	1C	W.Hart'pl
Harrison, W...	2C	„
Hedgcock, Jas.	2C	Hull
Howgate, E. J.	1C	Sunderl'd
Kennedy, Wm.	1C	Aberdeen
Laidler, J. W.	2C	N.Shields
Lamb, V. C. ..	2C	W.Hart'pl
Lofthouse, A. W.	1C	Glasgow
Lothian, T. ..	1C	„
Macalister, D.	1C	„
MacDonald, D. J.	2C	„
Martin, P. ..	1C	„
McKenzie, A...	2C	Dundee
Middleton, Chas.	2C	Aberdeen
Morris, Arthur	1C	Liverpool
Mosser, J. ..	2C	Glasgow
Muir, R... ..	2C	„
Murphy, E. S.	2C	„
Niddrie, G. ..	1C	„
Nixon, Wm. ..	1C	Dundee
Porrohicatos, J.	1C	Sunderl'd
Roscoe, G. R...	1C	London
Slack, T... ..	2C	Glasgow
Smith, A. ..	1C	„
Smith, W. E. B.	2C	London
Sugars, Geo. ..	1C	Liverpool
Taylor, Jas. ..	1C	N. Shields
Thomas, John	1C	W.Hart'pl
Twaddle, Wm.	1C	N.Shields
Watson, A. ..	2C	W.Hart'pl
Waugh, James	2C	Glasgow
Weir, Fredk. ..	2C	Liverpool
Wilcox, H. W.	2C	N.Shields
Youngs, J. T...	2C	Hull

The Marine Engineer.

LONDON, DECEMBER 1, 1893.

Some papers of great interest have been read in the division of the Marine and Naval Engineering and Architecture at the World's Columbian Exhibition. Of these we have before us that read by Mr. James Weir upon "Steam Engine Boiler Feeding," from which much valuable information may be drawn, based upon the author's practical experience of many years in the subject. In dealing with the principles of economy that determine the efficiency of the engine, Mr. Weir commences with the axiom that the efficiency depends, "(*a*) on getting the full initial or boiler pressure on the piston, and (*b*) on returning the feed water as near the exhaust temperature as possible." No one, we think, will dispute these axioms, but Mr. Weir points out that in practice these objects are sought to be obtained by means as hurtful in their principle of application as they might be beneficial in their effect, thus as in taking live steam from the boiler to further heat the feed water. This will indubitably be done when the feed water enters the boiler by spray diffusion, or where perfect circulation exists, and had far better be done in that way than by any attempt to do this externally to the boiler by the waste of live steam. It is pointed out, however, that so long as an air-pump is required to remove the condensed products of a hot well, the temperature of such condensed products must necessarily be much less than the temperature of exhaust or re-evaporation will ensue under the suction stroke of the air-pump. To raise then such condensed products from their necessarily reduced temperature to that of the exhaust steam before it is returned to the boiler, and without the waste of the initial heat of the live steam, is a problem that does not yet seem to have been solved. The exhaust steam, before condensation, may be utilised to some extent to do this, and economisers, heated by what are termed the waste heat of the furnace after it has passed the boiler, are the next best means, but in a well-designed boiler there should not be much of such waste heat thus to utilise. Even when these objects are carried out one is obliged to admit that "the minimum expenditure in every simple engine is the total heat necessary to produce steam at the boiler pressure from water at the exhaust temperature." Mr. Weir submits "that every cylinder of a compound engine is a simple engine," and that, as a consequence, this postulate being admitted, each cylinder of the series ought to be treated as a simple engine, and the feed returned at the temperature of the exhaust of each cylinder. This can only be done by heating the feed to the temperature of the low-pressure exhaust and then to the temperature of the high-pressure exhaust. If, however, the postulate is rather that a compound engine is an equivalent of a continuous simple engine from highest pressure to the lowest pressure of exhaust of the low pressure engine, the reheating of the feed to the temperature of the low-pressure exhaust would fulfil the requirements of the preceding axiom. Upon the effects of feed water on steam boilers Mr. James Weir is an undoubted authority, and we are glad to learn from him that when a feed is being supplied from the main engines, the main engines being then necessarily working, and the boilers in full progress of evaporation, the circulation is so rapid and complete in a well designed single or double-ended boiler, that in no instance could the cold feed water, necessarily supplied at a lower temperature than the water in the boiler, be detected in any part. The oft rumoured dangers of a comparatively cold feed in these circumstances tending to produce irregular contraction and expansion thus seems to be a myth. But Mr. Weir points out that this danger is a real one where the cold feed is supplied by an auxiliary or donkey pump, for then the engines are usually stopped and the evaporation of the boilers is at rest. In this case the cold water will fall to the bottom and endanger the lower plates by contraction. Mr. Weir points out this may be avoided by leading such feed pipes through the boiler near the water level, and distributing the feed through the small holes in the pipes, or by leading the feed pipe into the steam space and delivering the water as spray amongst the steam. In the latter case, however, the escape of the dissolved air must be provided for, or otherwise the air or gas forms an envelope about each atom of water and prevents its effective heating. The easing of the safety valve to blow off is recommended as a means to promote circulation when the engines are standing. In the matter of corrosion, Mr. Weir draws the important distinction that the condensed feed water does not produce corrosion in the feed-heater, but will do so in the boiler after it has passed the feed pumps. He therefore concludes that the corrosive effect is due to the admission of air into the feed pumps to prevent "hammering." If the feed water contained in solution oxygen and nitrogen alone, a coating of oxide of iron would be formed, and if this were allowed to remain no further corrosive action would take place. The presence of carbonic acid, however, in the water, of which there is always a percentage in the air, alters all this for the worse. After the oxide of iron is formed this is attacked by the carbonic acid and charged into ferrous carbonate. This is dissolved in the water and reduced by the oxygen to iron oxide, which falls as powder, and the liberated carbonic oxide is free to attack

fresh oxide on the plates. The oxygen dissolved in the water would probably not attack the iron plates in the first instance, were it not released in a nascent condition by the raising of the temperature of the water or the diminishing of the superincumbent pressure. Mr. Weir considers the pitting, which occurs only on the back of propeller blades, is due to the nascent condition of the oxygen there by diminished pressure. Artificial circulation is therefore desirable during feed when the engines are standing, feed water should be at exhaust temperature, and feed pumps should not be allowed to take in air, and if this cannot be done with main engine pumps, auxiliary engines with a "control gear" to prevent them drawing air should be substituted.

THE publication of the Admiralty minutes on the proceedings of the court-martial assembled at Malta to inquire into the loss of the *Victoria*, and on the construction and stability of the ill-fated vessel, together with Mr. White's report on the cause of her capsizing, came just too late for comment in our last number. For one reason we cannot regret that this was so, since we are now able, after the lapse of a month, to chronicle an expression of approval, which is practically unanimous, from the professional and technical world of the pronouncements therein given to the country. This is grand, and most satisfactory testimony to the impartiality and care, the thoroughness and lucidity, which characterise the investigation and report coming from the office of the Director of Naval Construction. And,—as we felt called upon to say, in making reference to the catastrophe in August last,—while the settlement of who was to blame for the collision is unquestionably a matter of some moment; of far greater importance to the nation is the settlement of those larger and deeper questions raised by the capsizing and sinking of the vessel after she was rammed. The general structural arrangements of the *Victoria*, with the provision of watertight doors, armoured deck, protection-belt and bulkheads, is so similar in many respects to those of other ships in Her Majesty's Navy, that the public could not fail to experience a sense of relief on learning in such an authoritative manner that the loss of the ship was not due to any fault in the principle of construction. The Admiralty are quite clear on this point, and they carry with them the weight of expert testimony, and opinion, when they say that had the watertight doors, hatches, and ports been closed, the ship might, and most probably would, have been saved. Those who study Mr. White's admirable and unbiassed report, with the diagrams and plates presented therewith, and published by us in this issue, can hardly arrive at any other conclusion. The facts established by the evidence are comprehensively summarised in the minutes of their Lordships. Immediately after the collision the fore part of the ship gradually sank, and at the same time she heeled over to starboard. This movement went on for a short space of time, and then a lurch occurred which was followed by the capsizing of the vessel. Up to within a minute of the impact of the *Camperdown*, a large number of watertight doors, hatches, and ports were open for the convenience and use of the crew, and, owing to the fact that an insufficient time elapsed, many of those situated in the fore compartments, could not be closed after the collision took place. Therefore, not only were compartments thrown open to sea by the entrance of the *Camperdown's* ram, but water was also admitted to these additional spaces in the vessel. The sea rushing in gradually depressed the bow of the ship from its normal condition, some 10 ft. above water, to 13 ft. below water, or a total depression of 23 ft., while the stern rose about 6 or 7 ft. Such a change of trim could only result in a great diminution of her stability, while, at the same time, the list to starboard increased until the inclination was between 18 or 20 degrees. This change of position was due to the gradual flooding of compartments adjacent to, or in communication with, those breached by the collision. The water now entered the armour door on the starboard side at the forward end of the battery, the 6-in. gun-ports on the battery on that side, and the ports in the turret. This inrush of water, accompanied by the descent of large quantities of water from the upper deck through the open hatchways, had the effect of destroying the ship's stability, and caused the lurch which preceded the capsize. Here we have a series of facts proved by the evidence of those who were on board the ship, or witnessed the disaster from other vessels. The only question that remains for decision is whether the ship would have remained afloat had the watertight doors, hatches, &c., been closed in time? This question is answered in the affirmative by the investigation and calculations which Mr. White has caused to be made, and which are fully set forth in his report. Our readers will be able to decide for themselves whether we are justified in our belief that this reply is the correct, and only one that could have been made, considering all the circumstances. It will be observed that two matters which have been brought forward in connection with the disaster are not referred to in the above; the first is the effect of longitudinal bulkheads, the second, that of an armoured belt. It was said that the provision of the former must have assisted to cause the loss of the stability, and that had the latter been provided it would have saved the ship.

The report will be found to contain a refutation of these assumptions, which, we believe, will carry assurance to those who read the evidence with unbiassed minds. Finally, there is the lesson which the authorities have taken to heart: a rearrangement of the stations for closing watertight doors will probably be made, and new regulations will be issued on the subject. The fact that these are deemed necessary would prove, if proof were needed, that no responsibility attaches to those on board the ill-fated ship for not making further endeavours in this direction in the time at their disposal. It is a moot point also, whether, by lessening the number of doors, hatches, &c., the efficiency of the ship could be augmented, and the facilities for saving a ship in case of like mishap, which might arise from gun-fire or torpedo explosion equally as well as from the effect of ramming, be increased. As to the apportionment of blame for the collision, there is little that need be said here, where matters of discipline and management concern us less than matters of construction. The Admiralty minute on the subject conveys censure to the Rear-Admiral and to the Captain of the *Camperdown* for placing upon the signal an interpretation it could not be made to bear, and for not taking precautions that might possibly have prevented the collision, and in any case would have minimised its effect. In other words, it is plainly intimated that the evolution, dangerous as it was, could have been performed with safety if the officers in charge of the *Camperdown* had used all the means at their disposal. By the use of the twin screws they could have so diminished the turning circle of their ships as to pass clear of the *Victoria*; they did not do so because they believed that the Commander-in-Chief intended something which no proper interpretation of the signal could justify. For this they are blamed but the causes of the mishap lie deeper still. They are to be found, we believe, in a loose system of manœuvring which has superseded to some extent those systems which were based on experiment and trial, and here again it will probably be found that the lesson is not without salutary effect.

An agitation for a new Naval Defence Act is now in progress, and is receiving the support and sympathy of all thinking men throughout the country. It is a pity that it should be necessary to agitate for an increase of the Fleet, but this kind of expression of public opinion appears to be inseparable from our system of party government. Not that there is very much difference of opinion between the two great political parties as to the need of providing the country with what Mr. Morley, at Manchester, the other day, called an "all-powerful" Navy, but it is the question of finance which provides matter for discussion. At present the shipbuilding Vote depends largely upon the whim of the Chancellor of the Exchequer, who is naturally averse from spending more money than he can help, especially if there is likely to be a deficit in the Budget. The agitation is therefore mainly directed towards taking this power out of his hands by the passing of a Naval Defence Act, which will be binding for a certain number of years, and which will not permit the needs of defence to be sacrificed to party emergencies of the moment. Since the present Government came into office, it is contended that nearly a twelvemonth has been lost in Naval construction, and a continuance of this "marking time" may be fatal to the interests of the Empire. Ministers have therefore been asked to propose a new programme, to put this into an Act, and bring it before the House of Commons without delay. This was the plan of the last Administration, and the *Times*, in a series of admirable articles, has demonstrated how it has given us a splendid fleet of ships, and maintained a continuity of Naval policy with the greatest possible benefit and advantage. The arguments in favour of following a like course have been put forward with cogency, much sound reasoning, and are now supported with incontrovertible facts. There can be no question that the Navy needs increasing, for it has fallen below the standard which the country has accepted as its minimum requirement in this matter. The growth of foreign Navies has been quite abnormal recently, the introduction and maintenance of a Russian fleet in the Mediterranean is a new factor in the situation, while the needs and necessities for the defence of our commercial responsibility and seaborne commerce continue to expand. Thus the fleet must be proportionately augmented on the principle that our sea forces must be superior to those of the two next strongest Naval Powers. This is a simple rule, as Sir Thomas Sutherland says, which the public can thoroughly understand. But superiority is not maintained by the addition of one ship or two. There are laws in Naval strategy and warfare which cannot be gainsaid. Should her interests all over the world be threatened, Britain must be ready to defend them everywhere, and the only policy is offensive warfare, that is to say, wherever the enemy's vessels are to be found there must ours be in sufficient force to give victory. Superiority, adequate for this purpose needs be, as Lord Charles Beresford has pointed out, at least one-third in numbers, and we are far below that preponderance at present. Attention has been particularly directed to the forces which Great Britain, Russia and France have at the present time in the Mediterranean, but this is only one aspect of the situation. It is obvious that to

make ourselves strong in the Mediterranean and to remain weak elsewhere, is as much a mistake as to be weak altogether. It is a vital matter with us to have command of the seas, as has been well shown in the current number of the *Quarterly Review*, where there is an article on the subject we commend to the earnest attention of our readers. Command of the seas can only be maintained by an overwhelming force everywhere that our interests can be imperilled, a view capitally put forward by Admiral Colomb in a letter to the *Times*. A Navy that is inadequate for its purpose is dear at any cost, but a Navy sufficient for our needs must be cheap. It is now for the public to insist that such a Navy is provided, and when we say a Navy, we mean officers and trained men as well as ships, for the one is of little value without the other.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.

On Tuesday, November 7th, the tenth session of the North-East Coast Institution of Engineers and Shipbuilders was inaugurated in the Lecture Theatre of the Durham College of Science, Newcastle. Mr. Robert Thompson, of Sunderland, President of the Institution, was in the chair.

The Secretary, Mr. John Duckitt, presented the report of the Council of the ninth session. It stated that the gold medals for the eighth session had been awarded as follows:—The engineering medal to Mr. J. Jennings Campbell, for his paper on "Engines for Ships of War;" the shipbuilding medal to Mr. M. C. James, for his paper on "Tonnage Measurement." In the Graduate section a still further improvement had taken place, and the meetings had been better attended. The prizes for the best papers read in this section during the eighth session were awarded as follows:—First award to Mr. J. King for his paper on "Some Notes on the Propulsion of Paddle Steamers;" the second award was divided between Messrs. E. Towers and R. L. Gaine, the former for his paper on "Hydraulics and Hydraulic Machinery," and the latter for his paper on "Steamship Trials." During the past year the following additions have been made to the list of members:—67 members, 7 associates, and 35 graduates; and 18 graduates had been raised to the rank of members. The total number of members was now 894.

The balance-sheet was also presented, showing that the receipts, including a balance of £730 2s. 8d. from the previous session, had been £2,394 15s. 1d.; and the expenditure £1,455 7s. 2d., leaving a credit balance of £949 7s. 11d.

It was intimated that 27 new members, 13 associates, and 12 graduates had just been elected.

The President, in his inaugural address, said the financial position of the Institution continued to be very satisfactory, and although the unpaid subscriptions were large, he trusted that the Council's hope that this item would be considerably reduced would be realised. The funds of the chair of engineering and naval architecture in the College of Science were less than last year, but since the report was issued they had received £30, making the total £424. He had taken the responsibility of that fund into his own hands, and he was certain that, should the college require it, they could maintain the chair for another period of three years, provided that, at the termination of that time, the college would undertake to carry on the chair permanently, as he had no doubt they would do. They would be in a position shortly, through the generosity of a large number of firms in this and other districts—27 in all—to present to the college from the Institution an experimental quadruple engine, with boiler complete, the total estimated cost of which was about £3,000; so that, coupled with the machines already presented to the college by its supporters, the machinery department was in a very good position, and they only required an experimental tank to make the engineering and shipbuilding requirements complete. He trusted that at an early date a future President might be in a position to announce that that tank had been added to the advantages offered to the students at that college. If funds could be obtained for the establishment of lectures at the various centres of engineering and shipbuilding on the North-East coast, the benefits of the college would be more widely diffused, and the interests of the district considerably furthered. The report of the Council for the past session was of a satisfactory character. The papers read were all of great practical value, and the discussions showed that a considerable number of the members had a thorough grasp of the questions raised, and possessed good debating powers. The present session promised to be of an interesting character, so far as the reading of papers was concerned. He feared the engineers were rather backward. The graduate section continued to improve, and he hoped that an application to the authorities of that college to allow them to hold their meetings there in the future would be granted. He still looked forward to papers of practical value being contributed by some of their shipowning members or their superintendents. They could give the actual results of work done by different forms and types of vessels. There was a resolution on the minutes to the effect that any member might by communication addressed to the secretary, petition the Council to lay before a general meeting of the Institution the contents of any letter which would in a short, concise, and clear manner draw the attention of the Institution to public matters of importance in connection with legislation proposed by any governing body in reference to the construction of ships, machinery, or the working of the same, so that members might, by their scientific and practical knowledge, demonstrate the soundness or otherwise of the proposed measure. They did not appear to have been taken advantage of, although it presented a good field for useful discussion. There was the question of the calculation of the free board in steel and iron vessels. They had the various Merchant Shipping Acts. Take the tonnage laws now in force. They might ask—since the water ballast tanks in the main body of the vessel were allowed off tonnage—why no reduction was made for that portion of the fore-and-aft peaks built and used exclusively for water ballast? why a reduction was made for store rooms, none was made for the space occupied by fresh water tanks for the use of the crew, or the space taken up by chain lockers, cables being essential to the safe navigation of the ship—There were many important engineering questions upon which valuable discussions might be started. The sub-committee of Lloyd's, while not having effected or attempted to effect any very radical change in the rules, had been instrumental in assisting to bring about a more uniform practice in carrying out the rules. The innovations were a step in the right direction, but the utility of the sub-committee could be considerably increased if the drawing office staff of Lloyd's were augmented. At present it was impossible for the staff to keep pace with the improvements put forward by shipbuilders and engineers. Considering the large reserve fund which had accumulated at Lloyd's Registry, this addition could be easily made, and would add greatly to its usefulness. In Mr. Martell they had an exceptionally able chief, one of wide and exceptional experience. But was it right that the responsibility should be so centred? He thought it was unfair to Mr. Martell, and unjust to the shipowning community, who subscribed so largely to the funds. He was tempted to say something about trade prospects. These were very gloomy. The only ray of hope seemed to be that things could not be worse, and that any change, therefore, must be of an upward tendency and for the benefit of both capital and labour. With regard to the latter, it seemed to have been forgotten that the so-called capitalist of to-day was the working man of a hundred years ago or less. What was wanting was that emulation of labour which used to exist. With better education, we should have a higher moral standard, the cultivation of sober habits and thriftiness, more truthful and direct dealing with each other on both sides. There ought to be a feeling that the two must go together; because, so soon as they became antagonistic, the particular trade they were interested in must suffer, and thus entail loss on both parties. The tendency of present arrangements seemed to be that of immediate convenience rather than of principle. In the end, this was sure to lead to disagreement and collision. He hoped that in the future capital and labour would be more closely allied, leaving capitalists free to give in their particular branches of business full scope to their energies and ingenuity. He hoped the session they were now entering on would be in every way successful, and that useful knowledge would be imparted; and that that Institution, in the days to come, would be regarded as having done a useful work in the advancement of that scientific knowledge by which alone the commercial supremacy of this great Empire could be maintained.

A cordial vote of thanks was given to Mr. Thompson for his address.

Mr. W. Hok, Member of Council, contributed a paper on "A method of comparing steamship performances—and the estimating powers and speeds of ships."

REPORT BY THE ASSISTANT CONTROLLER AND DIRECTOR OF NAVAL CONSTRUCTION, BASED UPON MINUTES OF PROCEEDINGS OF THE COURT MARTIAL APPOINTED TO INQUIRE INTO THE CAUSE OF THE LOSS OF HER MAJESTY'S SHIP "VICTORIA."

IT has been thought desirable by their Lordships that the Minutes of Evidence given before the Court Martial on the loss of the *Victoria* should be carefully gone through, in order that all important statements made by witnesses on matters relating to the collision between the *Camperdown* and *Victoria*, and the circumstances attending the subsequent sinking of the *Victoria*, should be summarised and classified. Having been directed to undertake this work, I now submit the following remarks.

The Minutes of Evidence being voluminous, and the evidence bearing on the matters above mentioned being scattered over the whole of the Minutes, it appeared necessary to bring together in a tabular form and under various heads a summary of the statements made by various witnesses, giving the substance of each statement, as well as references to the original Minutes of Evidence. This has been done in the "Tabular Summary" annexed hereto, which is a digest of the evidence under the various headings therein contained. The references to the original Minutes will facilitate further investigation by any one desiring to form an independent opinion respecting the relative authority of different witnesses where their opinions differ.

As might be expected under the circumstances, witnesses are not in absolute agreement on every point. In many cases the impressions and estimates of individuals differ.

Such differences do not, however, affect the principal circumstances or the order of events from the time that the manœuvre began until the moment when the *Victoria* sank. On all essential matters there is practical agreement.

The investigations of the Court Martial were most searching, and have put on record in a definite form the causes contributing to the loss of the *Victoria*.

Their Lordships have desired also that I should prepare a Report based upon the enclosed Summary of Evidence, in which the main facts established by the Court Martial should be set out briefly and in order. This has been done in the following pages. For the most part the statements made are supported by unquestioned evidence. Where differences of opinion occur in the evidence, they are indicated: there are in most instances good grounds for reaching a decision, and an attempt is made to decide where the balance of evidence lies. In a few instances the evidence given before the Court Martial has been made the basis of certain calculations, the results of which are stated. Care has been taken to indicate clearly where the evidence is either criticised or supplemented.

From the evidence it is established that before the manœuvre began the ships were proceeding at a speed of 8·8 knots, the two lines being 1,200 yards apart.

When the signal to turn inwards 16 points was hauled down, the helm of the *Victoria* was put hard to starboard (35 degrees), which corresponded to a tactical diameter of about 600 yards. At the same moment the helm of the *Camperdown* was put at 28 degrees to port, which corresponded to a tactical diameter estimated at about 800 yards. Had the helm of the *Camperdown* been put hard to port, the tactical diameter would have been reduced about 20 per cent.

The two ships continued to turn under these conditions, until they had each turned through about 8 points, and were very nearly end-on to one another. Their distance apart at that instant was estimated at 2 or 2½ cables (400 to 500 yards). Both ships must then have acquired practically their full "swing" (or angular velocity) corresponding to the conditions of speed and helm-angle above stated. Apart from change of helm or alteration in speed and direction of the engines, the ships would have continued to turn in practically circular arcs from 8 points onwards.

At or near the 8 points position it was recognised in both ships that a collision was imminent, and steps were taken to avoid it if possible. The port engines of the *Victoria* and starboard engines of the *Camperdown* were ordered to be reversed practically at the same moment for the purpose of making the ships turn more quickly. These orders were given only about a minute before the collision took place. Assuming that the orders were executed with all possible despatch, these engines could have been working astern only a very short time before the collision, so that the movements of the ships could have been but little affected thereby. The evidence bears out this conclusion.

In the *Victoria* the order to reverse the port engines was quickly followed by the order to reverse the starboard engines. The tendency, therefore, during the minute preceding the collision, was to somewhat check her headway. Captain Bourke considers she was moving at about 6 knots at the instant of collision. Staff-Commander Hawkins Smith estimates the speed at not more than 5 knots.

In the *Camperdown*, according to Admiral Markham's and Captain Johnstone's evidence, it was intended to go *full speed* astern with the starboard screw; but, probably through some misunderstanding or error in working the telegraphs (not fault in the instruments), only *three-quarters' speed* astern was shown on the dial in the engine-room: and the starboard engines were so worked up to the instant of collision. Almost simultaneously the order was received in the engine-room to stop the port engines. The evidence of the engineer officer of the watch, and the chief engine-room artificer proves that the port engines were *stopped* for about one minute—that is, practically up to the instant of collision. They were then ordered to go three-quarters' speed astern. Admiral Markham stated that he ordered full speed; but the seaman working the telegraph asserted that he received the order three-quarters' speed and acted on it. The engine-room staff, of course, only knew what the dial showed, and obeyed that order. While the misunderstanding is to be regretted, it cannot have sensibly influenced the result, since the interval of time was so short.

Witnesses differ in their estimates of the speed of *Camperdown* when she struck the *Victoria*. Lieutenant Barr puts it at 4 to 5 knots; Captain Johnstone at 6 knots; Staff-Commander Hawkins Smith at 5 knots; Admiral Markham considered that the way of the ship had not been much checked.

This point admits of independent verification. The engine-room register of *Camperdown* shows that up to 8 points (90 degrees) in turning, the engines were running at 54 revolutions, corresponding to a speed on a straight course of 8¾ to 9 knots. In turning, this speed would, of course, be reduced. According to records of turning trials of similar ships at about the speed in question, the speed from 8 to 12 points on an approximately circular path would be about 75 per cent. of the speed on a straight course before the helm was put over. The *Camperdown's* speed therefore at the moment when the starboard engine was reversed and the port engine stopped, must have been about 6½ knots. In the brief interval—less than a minute—before the collision, this speed could have been but little lessened. Hence it appears that Captain Johnstone's estimate of 6 knots is fairly accurate, and not in excess.

This is confirmed by the fact that, as the *Victoria* was using about 25 per cent. greater helm than the *Camperdown*, her speed on the circular path from 8 to 12 points must have been checked more from that on a straight course than was the case in the *Camperdown*. Moreover, both the *Victoria's* engines were reversed before the collision and only one engine in *Camperdown*. Consequently the *Victoria* must have been moving more slowly than the *Camperdown*, and yet her speed as above stated was estimated at 5 to 6 knots.

There is practical agreement that both ships occupied about one minute in turning from 8 to 12 points, in which latter position they were when the collision took place. This estimate of time is confirmed by recorded observations on similar ships made during turning trials; and the fact that they were turning rapidly at the instant of collision had an important influence on the injuries received by both ships.

All the witnesses agree that the *Camperdown* struck the *Victoria* nearly at right angles. The weight of evidence is in favour of the view that the keel-line of *Camperdown* was about 10 degrees *abaft*

the beam of the *Victoria*, the keel-lines then being at an angle of about 80 degrees. This is confirmed by an examination of the paths actually traversed under similar circumstances by similar ships when turning from 8 to 12 points.

The blow was delivered on the starboard side of the *Victoria*, about 65ft. abaft the stem-head, and just before important transverse bulkheads which extended from the keel to the upper deck. These bulkheads are lettered E. and F. where shown on Plates III. to X.

With the estimated speed of 6 knots the "energy" of the blow delivered by the *Camperdown* must have been about 17,000 to 18,000 foot-tons. This is about the muzzle energy of a 12 in. 45 ton B.L.R. gun, the estimated perforation of its projectile being about 22½ ins. of wrought-iron armour.

Observers, for the most part, saw only the damage done to the upper deck of the *Victoria*. Several of the witnesses spoke of that deck having been broken and injured for a distance of 8 to 11 ft. from the side. Accepting this estimate of the extent to which injury or disturbance was carried, it obviously does not follow that the upper portion of the stem of the *Camperdown* actually penetrated so far.

The best evidence on this point is to be found in the damage done to the bows of the *Camperdown*. Drawings and photographs have been received showing the nature and extent of that damage. Using this *data* in association with the evidence given respecting the movements of the ships while they were locked together, it is possible to decide with some certainty how far the *Camperdown's* stem entered the *Victoria*. On this basis the actual penetration

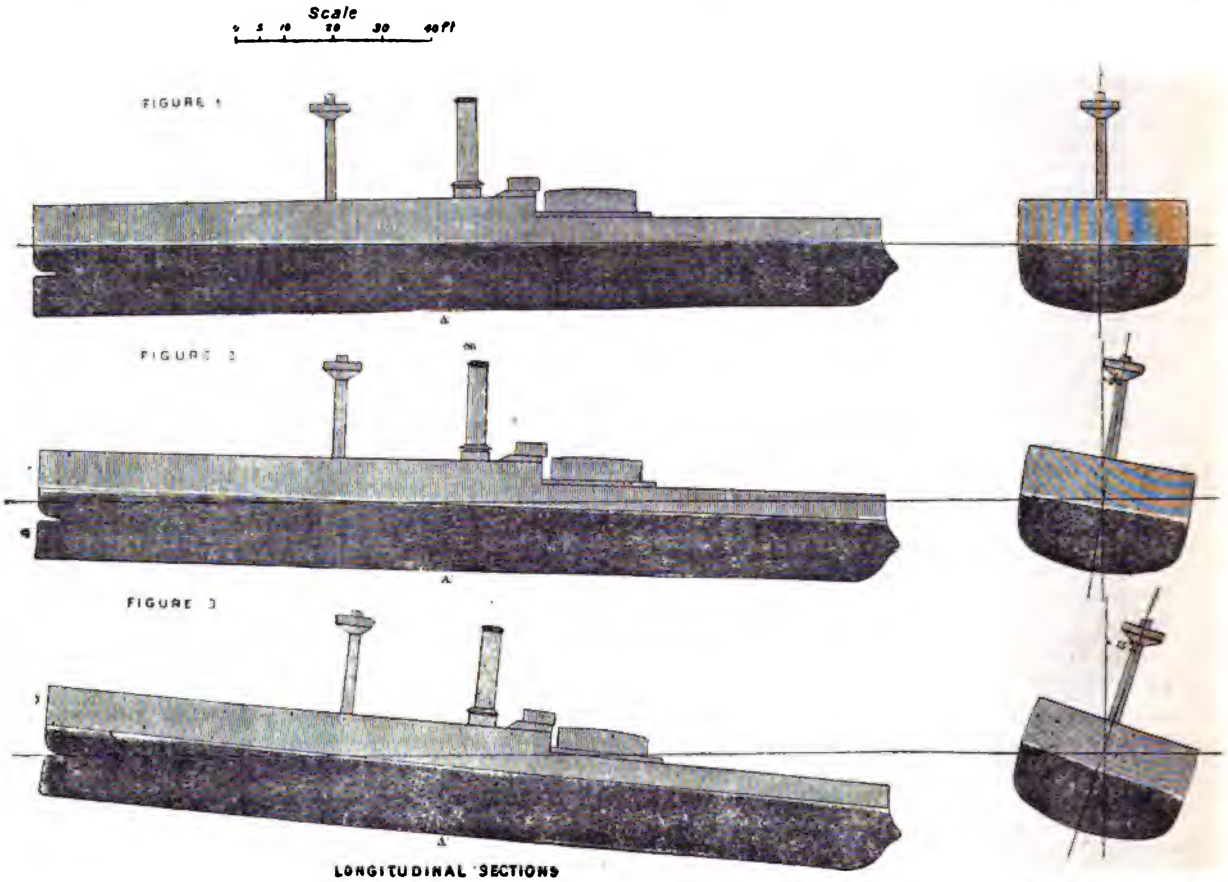


PLATE I.

Transverse Sections at A, looking from aft.

Figure 1.—Ship intact before collision.
Figure 2.—Calculated position of staple equilibrium of ship with compartments inevitably flooded, as shewn in blank on following plates:—
Figure 3.—Calculated position of staple equilibrium with compartments filled as in Fig. (2), and, in addition, those subsequently filled through open doors as shown in black on following plates, but supposing water kept out of turrets and battery (This is practically the position of ship before lurch took place.)

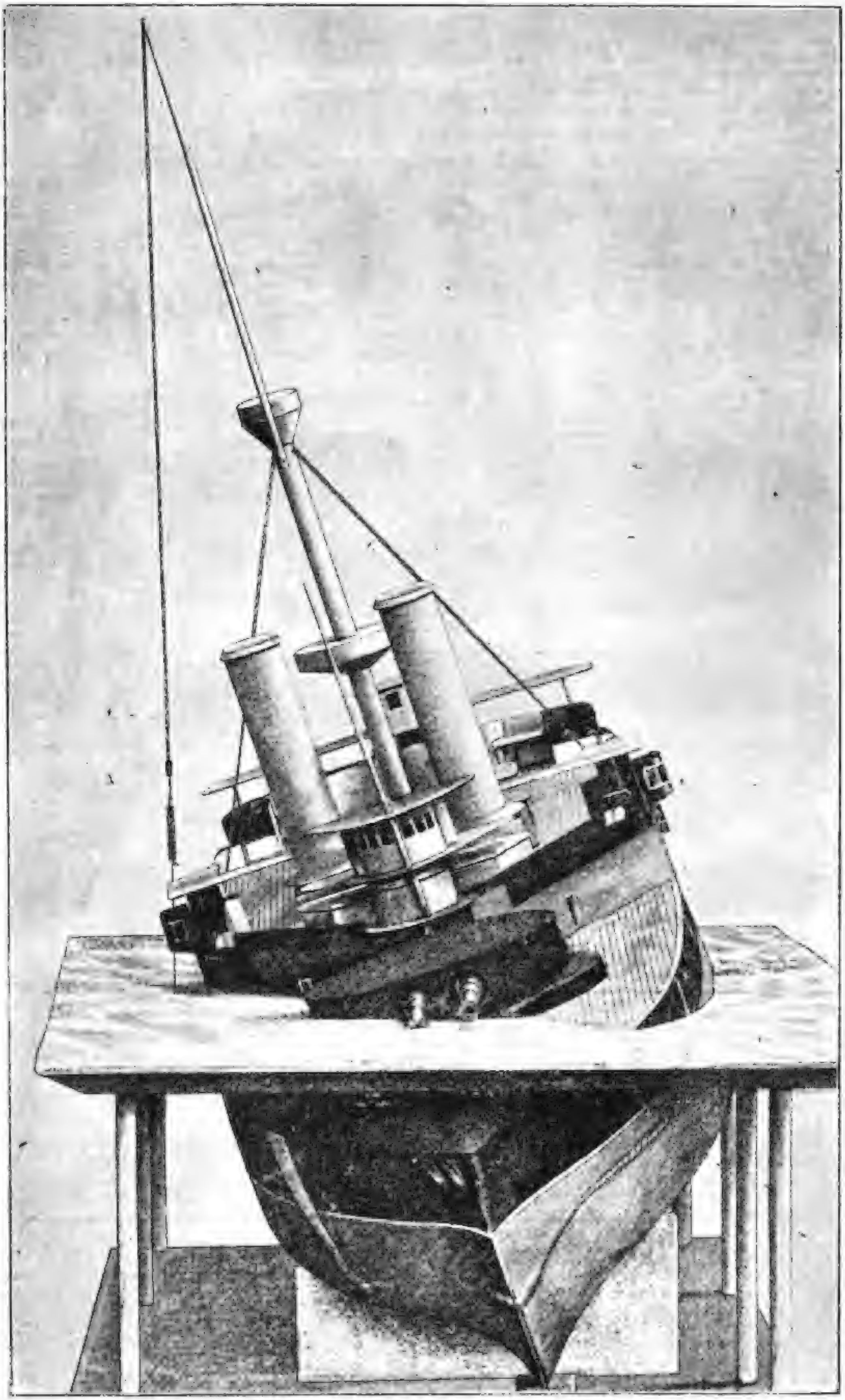
Observers agree that this terrific blow delivered on the bow of the *Victoria*, at a time when she was rapidly turning, caused the fore-end of that vessel to move about 60 or 70 ft. to port. This bodily movement of the *Victoria* absorbed some of the energy of impact, and tended to lessen the shock and injury done to the structure. Even with this reduction the shock must have been very great. It caused a tremor throughout the whole length of the vessel, and the noise of the collision was heard on board other vessels at some distance from the *Victoria*.

The upper decks of the two ships were nearly at the same height above water. Before the *Camperdown* was "brought up"—which must have been done chiefly by the strong under-water protective deck of the *Victoria*—her stem and ram-bow penetrated some distance into the side of the *Victoria*.

(normal to the side) of the upper portion of the stem is shown to have been 5½ to 6 ft. (See Plate IX.)

When the ships collided, as explained above, they were both turning rapidly. Consequently after the bow of the *Camperdown* was engaged in the side of the *Victoria*, the sterns swung together to some extent. This fact was noted by several witnesses. Those most competent to form an opinion (particularly Lieutenant Barr of the *Camperdown*) state that the movement involved a swinging of the *Camperdown* relatively to the *Victoria* through an arc of about 20 degrees. It is stated further that the two ships were locked together for about a minute, before the *Camperdown* backed astern and cleared—which she did at an angle of about 30 degrees abaft the beam of the *Victoria*.

This swinging together of the two ships exaggerated the



Admiralty Model illustrating the Loss of H.M.S. "Victoria" just before Capsizing.

njuries done to both. For the *Camperdown* it probably meant the fracture of the stem-forging; and it certainly involved very serious damage to the thin side plating on the port bow, which plating was broken through by contact with the side and decks of the *Victoria* abaft the breach made by the first impact. On the starboard bow of the *Camperdown*, where the swinging was practically a freeing movement, the damage done was relatively inconsiderable.

The damage to the port bow of *Camperdown* was chiefly caused by contact with the protective deck of the *Victoria*. The main part of the bow plating on both sides of the *Camperdown*, both above and below water, retained its general form. In swinging, therefore, the bow of *Camperdown* must have crushed in the adjacent plating and structure of the *Victoria*, and produced a serious enlargement of the breach caused by the first blow.

Moreover, it must have destroyed the water-tight connection to the side plating of the important transverse bulkheads E. and F., situated just abaft the place of collision. Those bulkheads consequently ceased to be watertight partitions for several feet from the starboard side of the ship.

point or "spur" of the ram bow projects about 7 ft. before the upright portion; and this spur pierced the thin plating below the protective deck, as it was designed to do. Notwithstanding the form of the athwartship section of the *Victoria* at the place of collision, the spur of the *Camperdown* was driven about 9 ft. within the side plating, at a depth of about 12 ft. below water. (See Plate IX.)

These results are of interest chiefly as a check upon the estimates of eye-witnesses, as to the extent to which the *Camperdown's* bow penetrated. It is important to notice, however, that even a considerably less penetration than that which has been shown to have occurred would have produced the same ultimate results by flooding the compartments to which water flowing through the breach could find access under the circumstances of the collision.

The ram-bow of the *Camperdown* would have ripped open the thin bottom plating of the *Victoria* below the proctective deck even if the vertical portion of her stem had not penetrated sensibly. Moreover, the *Victoria* was moving directly across the bows of the *Camperdown* at a speed of 5 to 6 knots. Apart from any sensible penetration of the *Victoria's* side, therefore, it was

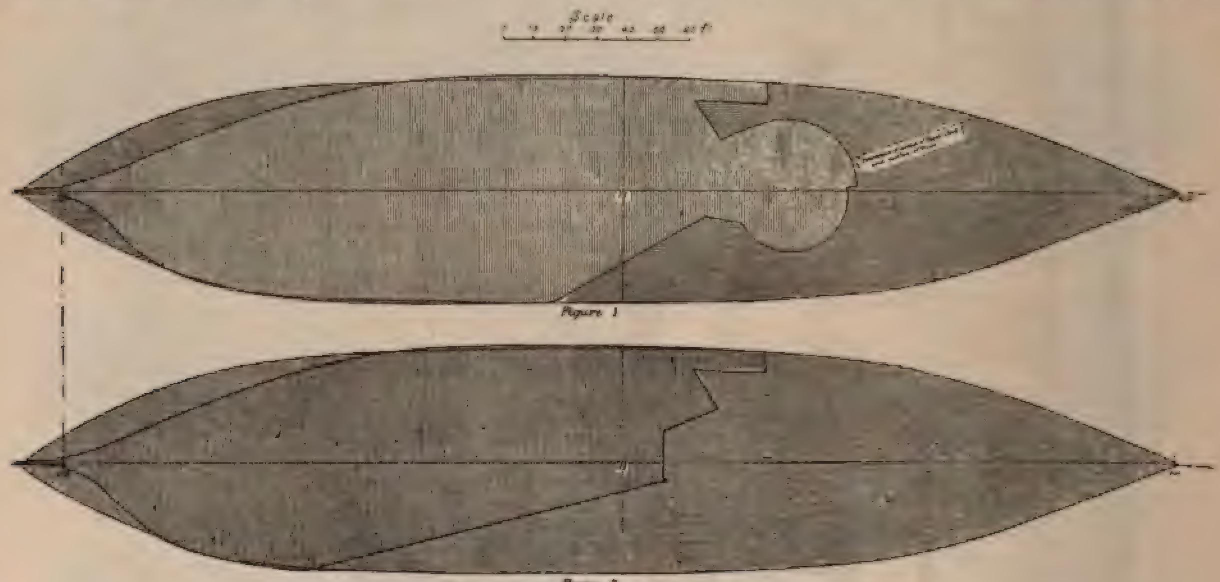


PLATE II.—WATER LINE SECTIONS IN VARIOUS CONDITIONS.

REFERENCES TO TABLE BELOW.

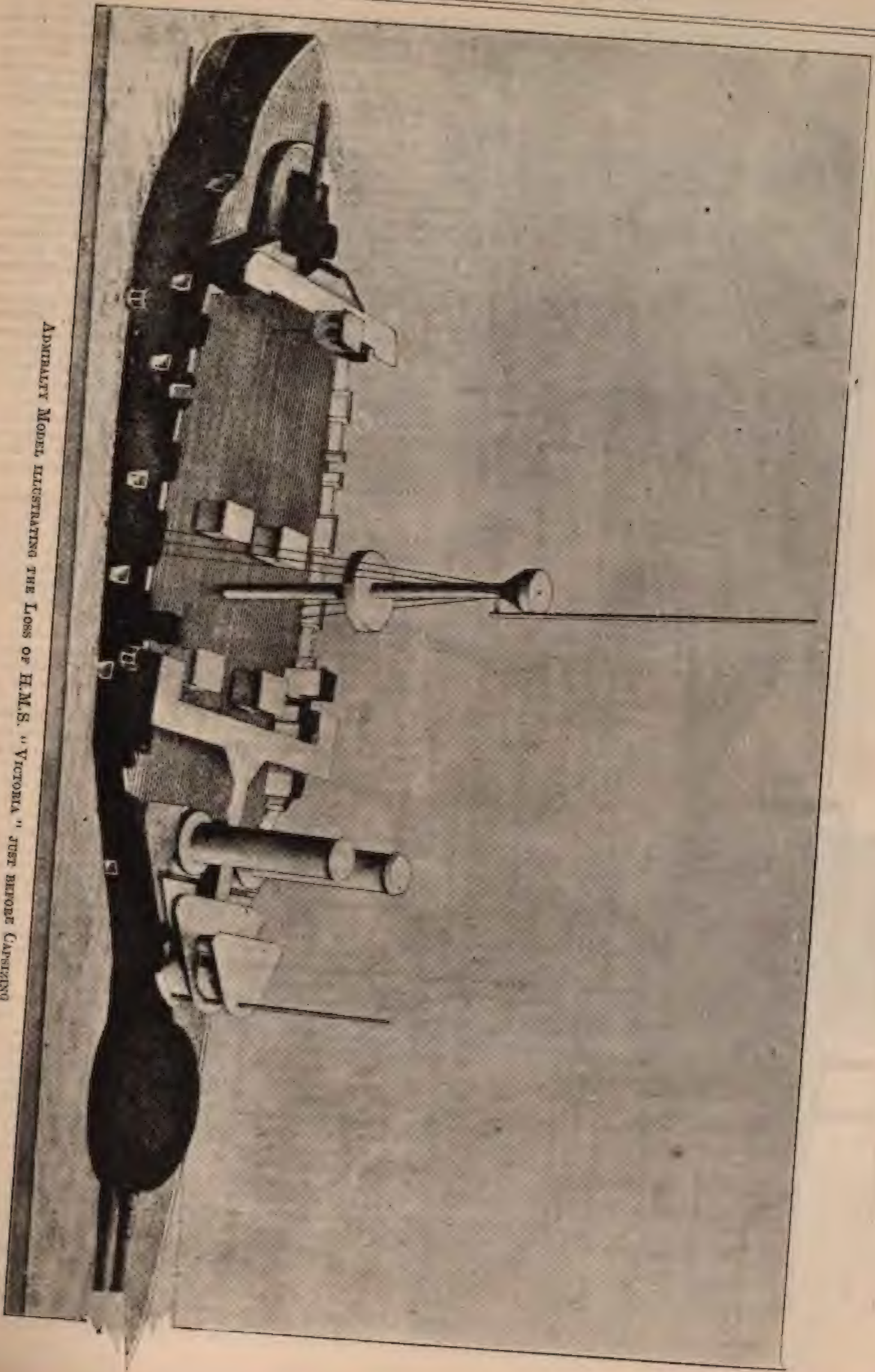
Case I.—Water line is outlined in black in Figs. 1 and 2.
,, II.—Water line is shown in black in Fig. 1.
,, III.—Water line is shown in black in Fig. 2.

Condition of Ship.	Transverse Moment of Inertia of Buoyant Water line (Plan of Flotation).	Transverse Metacentre above centre of Gravity.
I.—Ship Intact and upright	6,023,000	5·05 feet.
II.—Ship at trim and heel observed just before lurch with water excluded from turrett and battery ...	3,888,000	·8 feet.
III.—Ditto, but turret and battery flooded	2,783,000	1·8 feet.

A careful examination, based upon the known injuries to the plating on the *Camperdown's* port bow, and the angle abaft the *Victoria's* beam to which the *Camperdown* swung while she was locked, gives what must be a very close approximation to the extreme penetration into the side of *Victoria* effected by the stem of *Camperdown*. The result of this examination is shown on Plates IV. to X., and indicates as above stated a penetration of *about 5½ to 6 ft. for* the vertical portion of the stem. The extreme

inevitable that, if this forward movement of *Victoria* relatively to the *Camperdown* had taken place, her bottom must have been torn open for some distance abaft the first breach, during the time the vessels were in contact. This tearing action actually happened in the collision between the *Grosser Kürfurst* and *König Wilhelm*, when the former ship quickened her speed in the endeavour to clear the latter by crossing her bows.

As a matter of fact the *Camperdown's* bow was virtually *locked*



ADMIRALTY MODEL ILLUSTRATING THE LOSS OF H.M.S. "VICTORIA" JUST BEFORE CAPSIZING

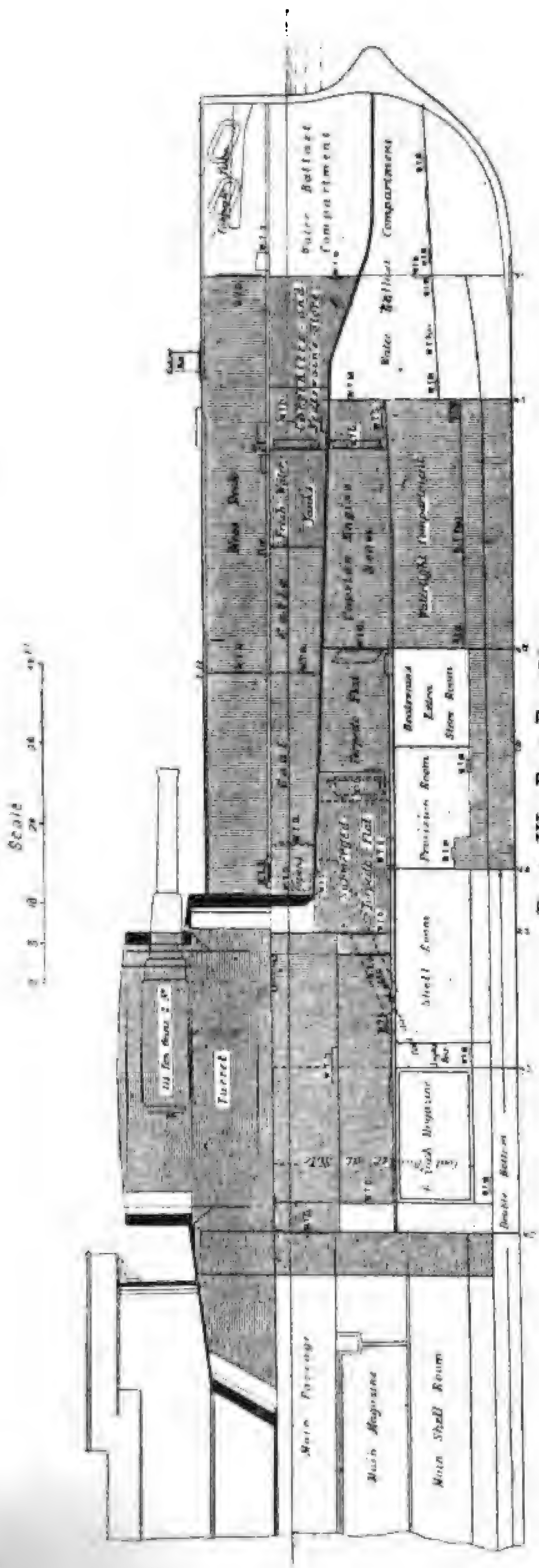


PLATE III.—PART PROFILE.

REFERENCES.

The various compartments are shaded to indicate their condition as shown by the evidence.

CONDITION.

Inevitably flooded through damaged side, decks and bulkheads. Probably filled after riding bitts were submerged.

Subsequently flooded through open doors, hatches and ports. Some of these may have been flooded, evidence is not clear.

W.T.D. indicates a Watertight Door. W.T.S. indicates a Watertight Scuttle. W.T.M. indicates a Watertight Manhole.

in the protective deck of *Victoria* during the time the vessels were engaged together. The relative forward movement of *Victoria* across the *Camperdown's* bow was thus practically destroyed, and consequently the tearing action of the spur on the bottom plating was lessened, although the swinging movement above described necessarily involved an enlargement of the breach.

It is possible, following the method above described, to closely approximate to the area and form of the breach made in the side of the *Victoria* by the collision and subsequent swinging together of the ships. The result is shown on the diagrams.

The breach must have extended vertically from the upper deck to a point about 28 ft. below that deck, and 18 ft. below the water-line at which *Victoria* floated before collision.

The width of the breach varied. At the upper deck it was about 12 ft.; at the original waterline about 11 ft.; then it gradually diminished in general breadth towards the lower termination. The area of the breach below the original water-line must have been 100 to 110 square feet.

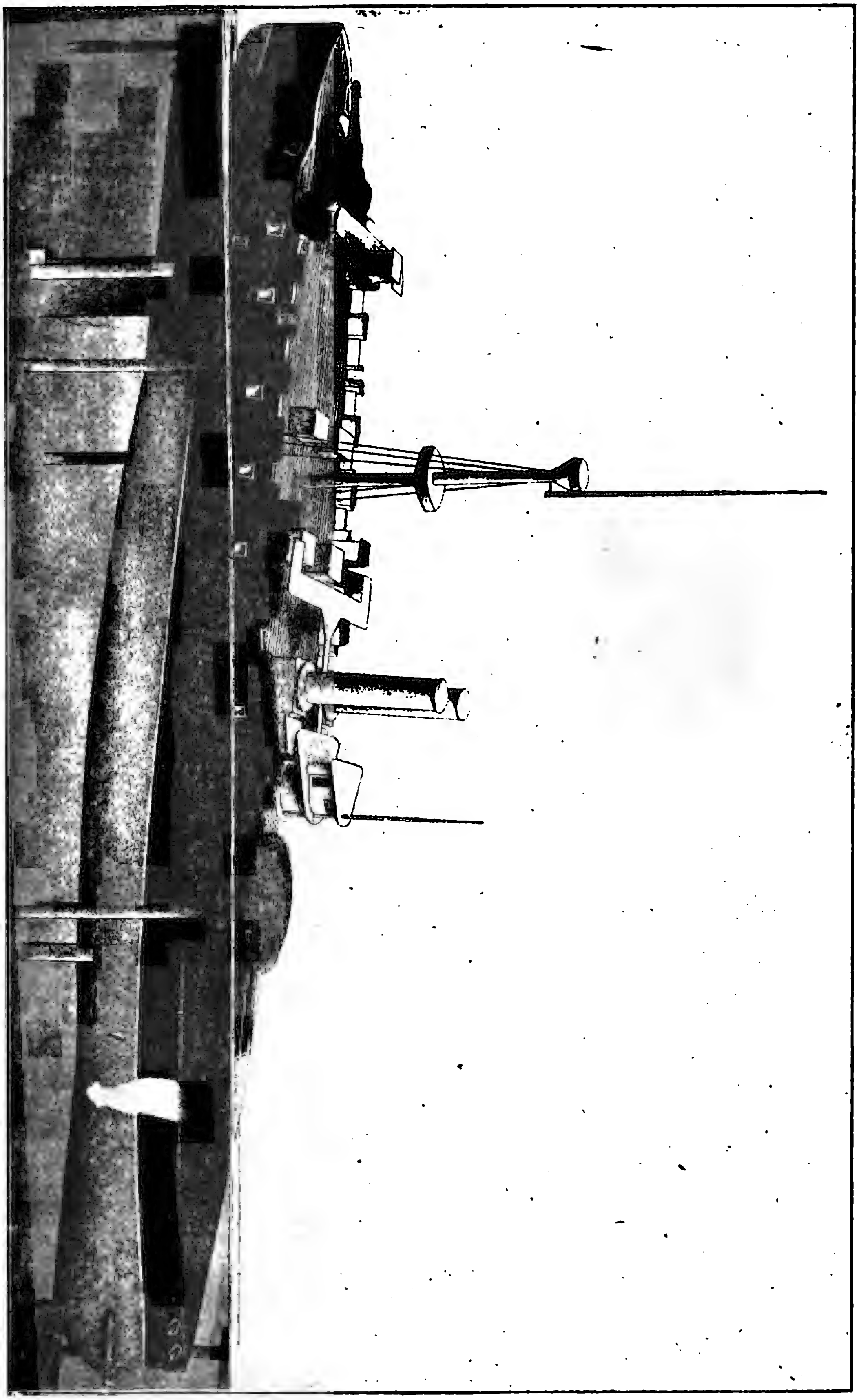
The bow of the *Camperdown* filled this breach to a large extent during the minute the ships were locked together. When the *Camperdown* went astern and cleared, the full area of the breach was left open to the entry of water. The initial rate of inflow of water through an unobstructed aperture of this size would be over 3,000 tons per minute. The actual rate of inflow was governed by many circumstances. Compartments which were directly breached by the blow and put in free communication with the sea must have filled very quickly. The compartments, in the aggregate, required only about 500 tons to fill them, so that they were probably flooded to a serious extent before the *Camperdown* cleared.

The whole arrangements of the water-tight subdivisions forward are indicated on Plates III. to IX. It will be seen that the spaces below the main deck were minutely subdivided by transverse bulkheads, horizontal decks and platforms, and a few longitudinal bulkheads. The governing idea, as in all warships, was to turn each compartment necessary for stowage into a separate water-tight enclosure, when doors, scuttles, &c., were closed and secured. The evidence establishes the fact that a number of these doors, &c., were open at the instant of collision, and could not be subsequently closed. Further, the shock of collision no doubt destroyed the absolute watertightness of some of the partitions adjacent to the place where the blow was struck, so allowing water to pass through interstices.

Water entering through the breach could not pass away into compartments adjacent to those first put directly into communication with the sea, at anything approaching the rate of inflow appropriate to the unobstructed motion due to the area and depth of the breach below the water surface. It had to find its way through doors, scuttles, &c., at a rate determined by the area and positions of these openings. Even when thus checked, the evidence clearly shows that a very large weight of water found its way into the interior, and passed for a considerable distance fore and aft in a very short time. A very great depression of the bow was observed within three or four minutes of the collision.

It is proved by the evidence that the watertight doors, hatches, &c., were in good order and perfectly efficient. The ship had been recently recommissioned at Malta, and had passed through the dockyard hands, all defects having been made good. The Chief Constructor of Malta Dockyard certified to this fact, and his evidence is confirmed by that of the officers of the *Victoria*. Moreover, the men who closed, or attempted to close, the doors, &c., with one single exception, made no statement suggestive of any fault in these fittings. The exception applies to a sliding door in bulkhead H. below the protective deck and just before the turret. This door could not be closed completely. No sufficient reason is given for the stoppage. Captain Bourke suggests that the shock of the collision may have disturbed the fittings. This view is not concurred in. The bulkhead in question is of exceptional strength, being one of the principal supports of the athwart-ship armour at the end of the belt. It is situated 35 ft. from the place where the blow was struck; and many doors much nearer to that place were shown by the evidence to be uninjured. Most probably there was some temporary obstruction to the closing, and the evidence of Rufus Ruff (Q. 1419-30) shows that he had no time to look carefully into the matter, as water was rushing into the compartment from forward.

It should be noted that the failure to close this door was not a matter of great importance under the circumstances; because the compartment abaft, to which (according to the evidence)



Admiralty Model illustrating the Loss of H.M.S. "Victoria" just before Capsizing.

water could find access, only contained 75 tons and the effect of that small additional weight of water was trivial compared with that of over 1,000 tons in other flooded compartments.

The true cause of failure to close the doors, hatches, &c., in the forward part of the ship is to be found in the very short time before the collision that orders were given to make the attempt. Captain Bourke states that under ordinary conditions of drill, with a trained crew, *three minutes* were required to close the doors, &c. It is also proved that the order to close doors was given about *one minute* only before the collision. The men were in their messes or on deck for the most part when this order was given. Using all possible exertions they could not reach the compartments forward, and especially those below the protective deck, in time to do much, if anything, before the collision had happened, and large quantities of water were entering. In the evidence this is conclusively proved by incidental statements made by the men. Abaft the turret the case was different; as water took some time to find its way into those compartments, the men could work without disturbance or danger, and the doors, &c., were closed and secured.

In the course of the enquiry many allusions were made to the possibility of partitions originally water-tight having ceased to be so in consequence of the great shock above stated, it is established by evidence that doors, &c., were not closed both in partitions which it is reasonable to suppose might have been affected by the shock, and in others which were further off the seat of injury, and consequently not likely to be disturbed.

From the evidence it is possible to ascertain, in considerable detail, facts concerning the behaviour of the *Victoria* from the instant of collision up to the time she foundered. The impressions of various witnesses have been grouped in the Tabular Summary of Evidence annexed hereto. It will be seen that, while there is agreement on important points amongst those who were well placed for observing the movements of the ship, other spectators, less favourably placed, give somewhat different accounts and estimates.

The most valuable evidence on these points is that of Staff-Commander Hawkins Smith and Flag-Lieutenant Lord Gillford, of the *Victoria*; Captain Moore, of the *Dreadnought*; and Captain Noel, of the *Nile*. These officers are in substantial agreement, and their evidence is supported by that of other witnesses in most particulars. From these sources the following account has been framed:—

The *Victoria* and *Camperdown* remained locked together about one minute. During this short time the *Victoria* is thought to

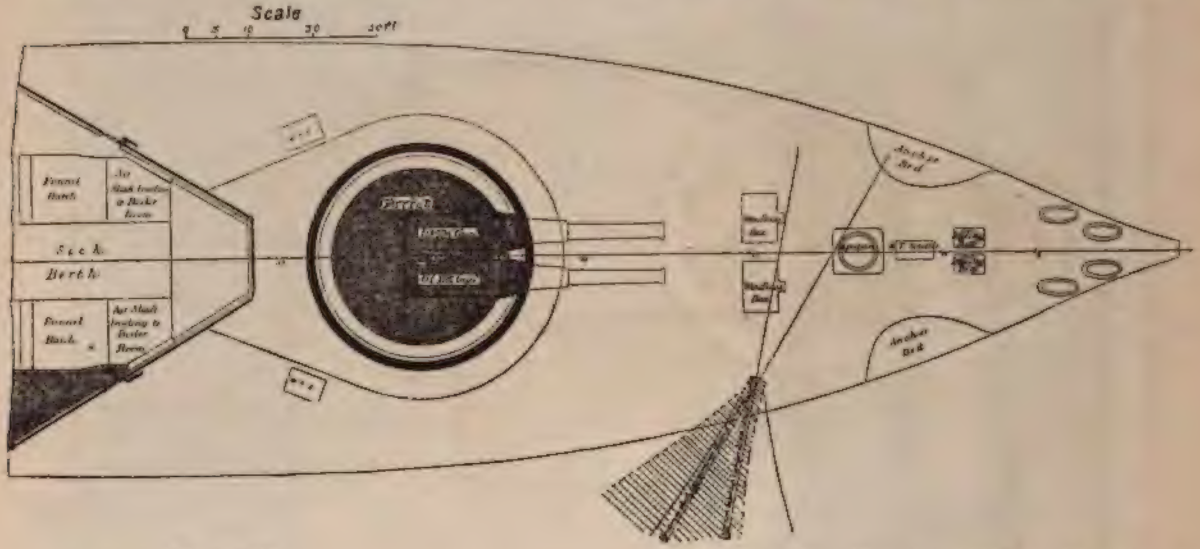


PLATE IV.—
PART PLAN OF UPPER DECK.

NOTE.—The form of bow of *Camperdown* at corresponding level is shown on starboard side.

REFERENCES.

The various compartments are shaded to indicate their condition as shown by the evidence.

CONDITION.

Subsequently flooded through open doors, hatches, and ports.

W.T.S. Indicates a Watertight Scuttle.

sustained by the structure. No doubt damage of the kind occurred in the immediate neighbourhood of the place where the blow was struck; and it is not possible to determine exactly the limits wherein such damage may have been sustained.

There is indirect evidence that the extent of serious disturbance by shock was not so great as some persons have supposed. For example, the anchor on the starboard side, only about 20 ft. before the breach, remained in place after the collision. Again, two witnesses testified that after the collision they were able to close and secure a door in the divisional bulkhead on the mess deck, only 10 or 12 ft. from the place where the blow was struck, and about 10 ft. from the ship's side. Experience in other cases of collision confirms the view that serious damage is likely to have been localized in close neighbourhood to the place where the blow was struck. This is quite consistent, moreover, with the tremour consequent on collision being felt at a considerable distance from that place.

The point has but little real importance, however, because, as have heeled slightly to the starboard side, and settled a little by the bow.

When the *Camperdown* had gone astern and cleared, the *Victoria* continued to settle by the bow and to increase her heel to starboard. For 9 or 10 minutes these movements continued to proceed gradually and steadily. Then came a "lurch" to starboard which commenced suddenly; the ship fell over on her side, and turning bottom up, finally sank by the head at an angle of 20 or 30 deg. to the vertical. At the instant the lurch began, the *Victoria* was steaming slowly ahead with both screws, her helm being hard-a-starboard. The intention was to make for the land.

For convenience it will be desirable to consider separately the two movements which proceeded simultaneously, viz., depression of the bow, and heel to the wounded (starboard) side.

It appears that about four minutes after the collision, the bow had dipped so much that water was coming through the hawse pipes on to the upper deck. That is to say, the bow had sunk about

10 ft. in four minutes. This change of trim continued, and about two minutes later the water had risen so much on the forecastle that men who had been working there were called away. Immediately before the lurch took place the water was washing into the open turret ports, situated nearly at the middle line 100 ft. from the bow, and at a height of 14 ft. above the original water-line. Captain Moore states that the water was then half-way up the turret-wall; and Captain Noel saw the water 2 to 3 ft. deep against the sides of the turret. On investigation it is found that at this moment (accepting Captain Moore's careful observations) the upper deck right forward was 13 ft. under water, having been depressed about 23 ft. below its original position. The forward part of the upper deck was then almost entirely under water, from the bow to the bulkheads forming the forward termination of the upper deck battery. In other words, nearly half the length of the ship was submerged. The after portion of the ship was lifted considerably above its normal position, and the upper blades of the port screw were showing above water to a large extent. The normal position of the tips of the blades was 11 ft. below water. This emergence of the screw was partly due to the heel, but chiefly to change of trim.

Lithographic reproductions of photographs obtained from a model of the ship are attached. These show her in the position at the forward end of the upper deck battery was partly under water. It has been given in evidence that this door was never closed. Consequently water was at the same time passing into the battery and accumulating on the starboard side. Captain Moore remarked also that the two foremost 6 in. gun ports on the starboard broadside were then *just awash*. These ports, according to the evidence, were not closed, and therefore when they became "awash" large quantities of water could enter rapidly. In these circumstances it is obvious that a sudden increase of heel was inevitable; and the ship had sustained such a loss of stability from the submergence of her bow and the rise of her stern that she could not recover herself, and eventually capsized.

Captain Noel describes the motion of the *Victoria* at this time in some detail. He says she fell over to starboard slowly at first, but afterwards with increasing rapidity. He adds the important fact that as this movement took place, boats and other weights fell to leeward with a terrible crash. This "fetching-away" of weights no doubt contributed to hasten the capsizing when the motion had begun. It is practically certain also that large quantities of water which entered the upper deck battery, through the open ports and armour door, must have passed below into the deck and hold spaces through open hatchways, doors, &c., thus flooding the ship and further accelerating her foundering.

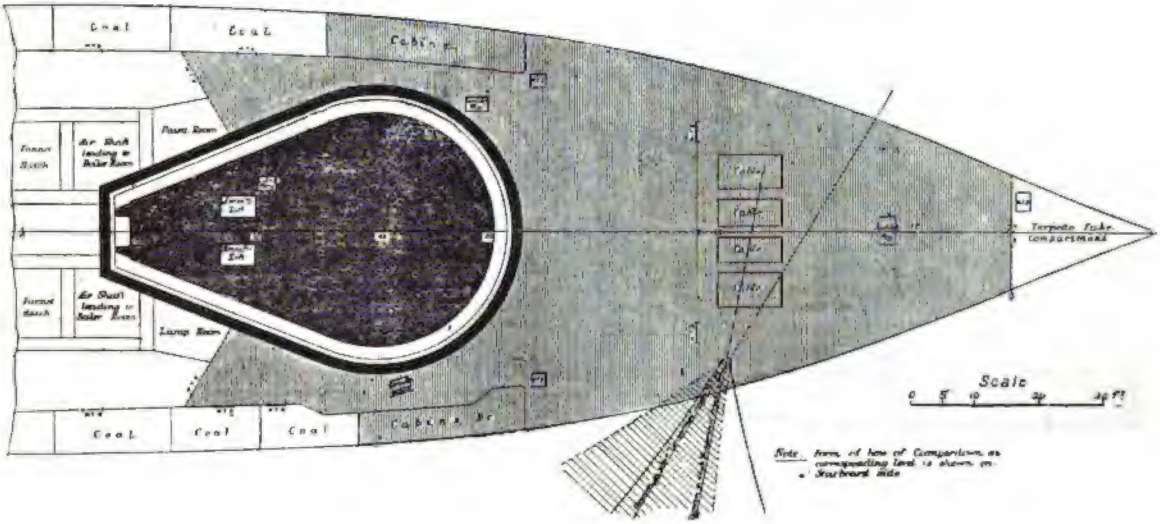


PLATE V.—PART PLAN OF MAIN DECK.

REFERENCES.

The various compartments are shaded to indicate their condition as shown by the evidence.

CONDITION

Inevitably flooded through damaged side, decks and bulkheads.

Subsequently flooded through open doors, hatches, and ports.

W.T.D. Indicates a Watertight Door.
W.T.S. „ „ Scuttle.

which she had reached before the lurch began, according to the evidence of the officers above-mentioned.

Simultaneously with this extraordinary change of trim by the bow, the *Victoria* was heeling to starboard. All the witnesses on board that ship agree that the motion was gradual and steady until the lurch took place. Their conclusion is supported by witnesses from other ships, and by the fact that 9 or 10 minutes were occupied in reaching a heel of 18 or 20 deg. from the vertical. There is practical agreement that this was about the heel to starboard at the moment when the lurch took place.

Captain Moore, who was taking note of the *Victoria* at that time, confirms this estimate; and adds some most important information. He saw the water half-way up the turret wall; and consequently it must have been flowing through the open ports into the turret, from which it could pass into the redoubt, surrounding the turret-base, and thence could find access to certain spaces below.

Further, he noted that the armour-door in the oblique bulkhead

The attempt made to steam towards the land with the helm hard-a-starboard tended to increase somewhat both the depression of the bow and the heel to starboard. It is true that only a low speed was reached, but with the forecastle buried deep under water, any headway tended to further "tip" and heel the vessel, and to accelerate the inflow of water through the turret ports and battery door. The transverse stability had been so seriously diminished by the submergence of the bow that inclining forces of small absolute amount, which would have been of no importance in the ordinary condition of the ship, produced an appreciable effect.

The hydraulic steering gear in the *Victoria* ceased to act very soon after the collision. Captain Bourke (Q. 67–69 and Par. 20 of Defence) attributes the circumstance directly to the inflow of water consequent on the collision. His opinion is concurred in. It is important to note that this steering gear had given no trouble previously; and that alternative hand-steering gear, placed far abaft the compartments flooded, was

still available for controlling the ship. This hand-gear could be brought into operation very quickly when required, and was of ample power for moderate speeds. That it was not used was undoubtedly due to the short time the ship remained afloat.

Passing from the behaviour of the *Victoria* during the interval before she sank, to the consideration of the causes which produced the great change of trim and the heel to starboard observed, it is necessary to examine closely into the facts placed before the Court Martial respecting the compartments which were flooded. The evidence on these points is exhaustive, and has been classified in Section VII. of the Tabular Summary annexed.

Up to the time when the ships had turned 8 points—or about one minute before the collision—no orders were given to close the water-tight doors, &c., then open. It was "make and mend" afternoon, and the men were in their messes. After the orders were given every possible endeavour was made to close doors and scuttles; but the time available was very short and the inrush of water was rapid. The Court Martial examined individually the officers and men who closed or attempted to close doors and scuttles. It is clear from the evidence that in some cases, doors, &c., which were attempted to be closed were not properly secured, or really made water-tight, the men having no time or being driven away by the inrush of water.

An important example of this occurs in the evidence relating to the door in the bulkhead E_2 at the forward end of the submerged torpedo room (see Plate VII.). Petty-officer Jacobs (Q. 1381-84) stated that he proceeded from the spar deck to this compartment and closed the door in question. It will be seen that the compartment before the bulkhead E_2 was breached, as the *Camperdown* swung while locked in *Victoria*: consequently it must have been in free communication with the sea. Jacobs confirmed this (Q. 1384) and admitted (Q. 1388) that he might not have completely secured the door. Another witness (Rufus Ruff, Q. 1423-25) proved that, whatever Jacobs may have attempted, water in considerable quantities was passing through the bulkhead at or near the place where the door was fitted, which Jacobs thought he had closed. This door was situated about 30 ft. from the breach made by the *Camperdown's* bow, and the nearest part of the bulkhead on the starboard side was about 10 ft. abaft the breach (Plate X.). It appears highly probable, therefore, that neither the bulkhead nor the door could have been seriously damaged, so as to admit the quantities of water seen by Ruff (Q. 1424), and that Jacobs failed to close the door, although he made the attempt.

This has been described both as a typical case of what must have happened in many instances under the circumstances, and because it is the only important point in which reason is seen to differ from the statement put in by Captain Bourke as to doors which were closed. Its importance arises from the fact that the flooding of the submerged torpedo-room involved the entry of fully 260 tons of water into that space, and its passage aft into spaces below the turret. Having regard to the evidence of Ruff, it is certain that the submerged torpedo-room was flooded.

On the basis of the facts set out in detail in Section VII. of the Tabular Summary of Evidence, diagrams have been prepared which graphically illustrate the extent to which the *Victoria* was flooded. The evidence of Captain Bourke has been generally followed: but on the unquestioned evidence above mentioned it has been accepted that the submerged torpedo-room was flooded. Further, the watertightness of the provision-room and of the compartment in hold between Stations 12 and 22, port side (Plate VIII.) has been taken as *not* destroyed by the shock of the collision.

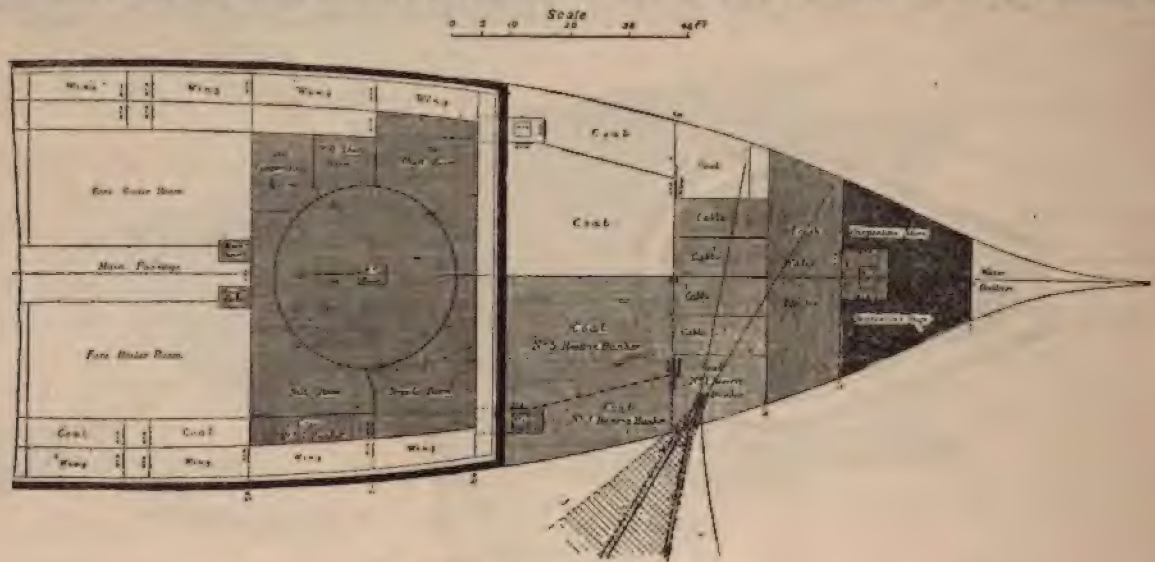


PLATE VI.—PART PLAN OF LOWER DECK.

NOTE.—Form of bow of *Camperdown* at corresponding level is shown on the starboard side.

REFERENCES.

The various compartments are shaded to indicate their condition as shown by the evidence.

CONDITION.

Inevitably flooded through damaged side, decks, and bulkheads.

Subsequently flooded through open doors, hatches, and ports.

Probably filled after riding bitts were submerged.

Some of these may have been flooded, evidence is not clear.

W.T.D. Indicates a Watertight Door. W.T.S. Indicates a Watertight Scuttle. W.T.M. Indicates a Watertight Manhole.

These diagrams show—

(*a*) The compartments which would have been flooded as a necessary consequence of the collision, if all doors, &c., in bulkheads and platforms had been closed prior to the collision.

(*b*) The compartments subsequently flooded through doors, hatchways, &c., which remained open after the collision.

(*c*) The compartments respecting which the evidence is doubtful, and into some of which water may have found its way because doors and hatches were not closed.

On these diagrams are also indicated the probable positions of the bow of the *Camperdown* as she struck, and after she swung towards the *Victoria* before clearing.

In deciding on the compartments under group (*a*) care has

been taken to include all spaces which could reasonably be supposed to have been injured by the collision in such a way as to permit access of water to them. It has been explained above that the extent to which the shock may have carried injuries is not absolutely determinable: but that there are good evidences that the principal effects were comparatively local.

The other groups are based strictly on the evidence, with the correction as to the bulkhead E_2 above described.

The facts represented graphically in Plates III. to IX. have been grouped in the following Tables. The flooded compartments have been enumerated and classified: and for each of them the "loss of buoyancy" consequent on flooding has been calculated in the Constructive Department of the Admiralty. These calculations are of the simplest character, dealing only with the *unoccupied spaces* in flooded compartments, and the positions of the centres of gravity of those spaces.

In the Minutes of Evidence (pages 132 to 133) it will be seen that the Court Martial had a somewhat similar statement presented to it by Mr. Newnham, Chief Constructor at Malta. That officer, however, had not the full evidence before him at the time, and made certain assumptions as to the compartments flooded which are not borne out by the evidence. For example, he assumed that on the platforms (Plate VII.), the water did not pass abaft the bulkhead E_2, whereas it was proved to have reached I. bulkhead about 36 ft. further aft than E_2. Under these circumstances Mr. Newnham's calculations do not represent the actual conditions, and need not further be considered. His estimates for the capacities of compartments are, on the whole, in fair agreement with those given in the following Tables:—

TABLE I.

Compartments shown by the evidence to have been thrown open to the sea, either by direct damage or through open doors, hatches, &c.

Name of Compartment.	Loss of Buoyancy, in tons.	Distance in feet from Middle of Length of Ship.	Distance in feet from Middle Line of Ship—Starboard side.
ABOVE PROTECTIVE DECK—			
Small compartment leading to capstan flat	8½	132	...
Fresh-water tank room	25	122	...
*Cable lockers	34	109	...
*No. 1 coal bunker, 18 to 23, starboard side	8	108	18
*Coal bunkers Nos. 3 and 5	33	87	14
Total above protective deck	108½		
PLATFORMS TO PROTECTIVE DECK—			
Compartment fore end of capstan room	18	130	...
*Capstan engine room	80	116	...
*Carpenter's store, 14 to 22	50	114	13
*Torpedo flat, 22 to 27	200	96	2 port side.
Submerged torpedo room	260	78	...
Spaces between 35, the ring bulkhead, and 43	75	62	...
HOLD BELOW PLATFORMS—			
*Water-tight compartment starboard side, 12 to 22	108	117	6
*Water-tight compartment below, from 12 to 22	20	117	4
*Water-tight compartment, 22 to 31, starboard side	50	88	18½
*Water-tight compartment below provision room, &c., 22 to 31	60	88	...
*Torpedo magazine, or guncotton magazine	33½	98	8
No. 7 coal bunker and shoot	47	44	25
Total below protective deck	1,001½	...	..
Grand Total	1,110	...	...

NOTES.

1. The compartments marked with an asterisk are those (included in group (*a*) above), which it is considered must have been flooded in consequence of the collision, even had doors, hatches, &c., been closed prior thereto.

2. For compartments above the protective deck the loss of buoyancy (108½ tons) is estimated up to the water-line at which the *Victoria* floated before the collision. This loss will be seen to be about 10 per cent. of the total loss. Had no loss taken place below the protective deck, the flooding of compartments named above that deck would have produced a change of trim of only 3 ft., and a heel of less than three degrees. When the compartments below the protective deck were also flooded, the change of trim became 29 ft.; and the heel to starboard 18 to 20 degrees.

TABLE II.

Compartments shown by the evidence to have been probably or possibly filled through doors, hatches, &c.

Name of Compartment.	Loss of Buoyancy, in tons.	Distance in feet from Middle of Length of Ship.	Distance in feet from Middle Line of Ship—Starboard side.
ABOVE PROTECTIVE OR LOWER DECK—			
Air compressing room, port side	22	39	16 port side.
Sail room, chest room, torpedo room, with turret support, 35 to 53	300	54	1½
PLATFORMS TO PROTECTIVE OR LOWER DECK—			
Compartment between bulkheads, 43 and 53, and turret support. Space for empty powder cases	200	47	...
HOLD BELOW PLATFORMS—			
Water-tight compartment, port side, 12 to 22	108	117	6 port side.
Port ejector tank	35	70	19 „ „
Total	665 tons	...	...

NOTE.—All the compartments mentioned in Table II., except those below platforms, are within the limits of the armour belt.

TABLE III.

Compartments ultimately filled through riding bitts by the depression of the bow.

Name of Compartment.	Loss of Buoyancy, in tons.	Distance in feet from Middle of Length of Ship.	Distance in feet from Middle Line of Ship—Starboard side.
ABOVE PROTECTIVE DECK—			
Boatswain's and carpenter's stores, 7 to 14	100	138	...

Taking the facts established by the evidence, and recorded in Table I., an inquiry has been made into the effect which flooding the compartments therein enumerated should have had upon the trim and transverse inclination of the *Victoria*. This inquiry has necessitated the performance of certain calculations in the Constructive Department of the Admiralty, these calculations being based upon well-known principles which are universally applied in estimates of the buoyancy and stability of ships. The following is a summary of results:—

1. The flooded compartments (19 in number), had a capacity which involved a total "loss of buoyancy" (up to the original water-line) of 1,110 tons; of this amount less than 110 tons were in compartments above the protective deck; and about 1,000 tons in the spaces below that deck.

2. This loss of buoyancy in compartments so far forward produced a "moment to change trim" of about 140,000 foot-tons. Of this total moment the 110 tons above the protective deck account for only 15,000 foot-tons—the balance, nine-tenths of the whole, being due to the water below that deck. The moment due to the 110 tons above the protective deck corresponds to a change of trim of 3 feet only. The additional moment due to the 1,000 tons below the protective deck brings up the change of trim to the enormous amount of 29 feet. Allowing, as is done only for compartments enumerated in Table I., the calculation shows the depression of the bow to be about 21 feet, and rise of stern 8 feet, as compared with their positions before the collision took place. Such a change of trim, however, necessarily flooded also the compartments named in Table III. Consequently the final depression of the bow, by calculation, fully equals that which was observed by several witnesses as having been reached before the lurch began, and which is estimated from their evidence at 23 feet.
3. As the bow sank, water entered the upper part of the vessel through the breach and filled all the space between the upper and main decks back to the oblique

6. As explained above, the sudden entry of water into the 6 in. gun battery above the upper deck through the open ports and door, caused the final lurch which led to the capsizing and foundering of the vessel.
7. Had the ports in battery and turret, and the armour door, been closed and water excluded from both battery and turret, the *Victoria* would not have capsized, and would have remained afloat for a much longer time even if eventually she had foundered.

It is not possible to state absolutely that the *Victoria*, with turret and battery closed, would have been kept afloat permanently under the actual circumstances of the collision. There are so many compartments (*see* Table II.) into which water may have found its way eventually, through doors or hatches respecting which there is no direct evidence whether they were closed or not. But this would have involved still further change of trim by the head; and her capsizing would have been improbable even if she had eventually foundered.

Allusion has been previously made to the great reduction in stability necessarily produced by such an extreme submergence of the bow and accompanying rise of the stern as were observed in the *Victoria* before the lurch began. This fact is well known to naval architects, and can be readily understood apart from exact calculations.

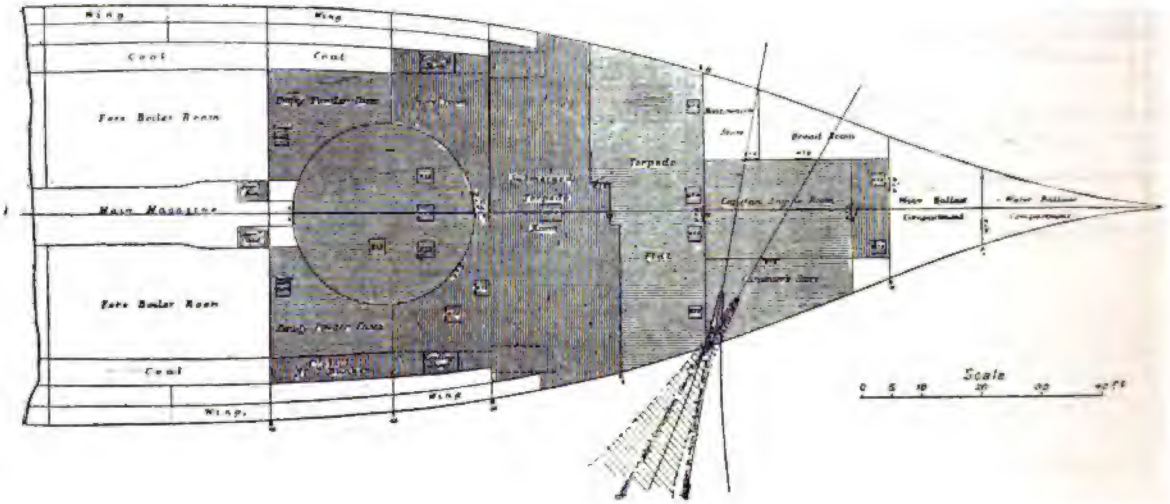


PLATE VII.
PART PLAN OF PLATFORMS.

NOTE.—Form of bow of *Camperdown* at corresponding level is shown on the starboard side.

REFERENCES.

The various compartments are shaded to indicate their condition as shown by the evidence.

CONDITION.

Inevitably flooded through damaged side, decks and bulkheads.

Subsequently flooded through open doors, hatches and ports.

These may have been flooded, evidence is not clear.

W.T.D. Indicates a Watertight Door.
W.T.S. " " Scuttle.
W.T.M. " " Manhole.

watertight bulkheads shown on Plate V. as situated just abaft the turret.

Certain small store-rooms (Plate VI.) were also filled from above as the bow sank, but this circumstance was relatively unimportant.

4. Neglecting water which may have entered through the turret ports, when the *Victoria* had reached the position occupied before the lurch, there must have been about 2,200 tons of water in the interior of the ship; before the fore boiler-room and below the upper deck (Plates III. to IX.).
5. The case was aggravated by the entry of water into the turret, redoubt, and spaces below.

The power of a ship to resist inclination from any position in which she floats at rest, depends greatly upon the moment of inertia of her buoyant water-line section (or plane of flotation). Any causes which reduce this moment of inertia lessen the stability. To illustrate the remarkable change which the submergence of the bow and consequent entry of water into the *Victoria* produced upon the form of the buoyant water-line section, two diagrams have been prepared (Plate II.).

The first diagram shows the form of the water-line section of the ship when intact, as she floated before the collision, contrasted with the corresponding water-line section which she must have had before the water entered the turret through the gun ports and the upper-deck battery through the armour door and

6-in. gun ports. In the latter condition the power to resist transverse inclination still remains, but is only about *one-sixth* of the corresponding power when the ship was intact and upright. Before the collision the *Victoria* had a metacentric height of 5 ft. After the collision, when her bow had sunk deeply and she had heeled considerably, the corresponding metacentric height was about *eight-tenths* of a foot.

The second diagram in Plate II. similarly contrasts the water-line section when the ship was intact and upright, with her water-line section when the water had entered the battery and turret, as observed at the moment before the lurch began. The consequent reduction in buoyant water-line area caused a still further fall in the metacentre, and instead of being 5 ft. above the centre of gravity, it was 1·8 ft. below that point. In other words, the ship had become unstable and lost the power to right herself.

Submergence of the bow and entry of the water also seriously diminished the power of the ship to resist changes of trim. In the damaged condition this was only about *one-third* as great as in the intact condition, even supposing water to be excluded from the turret and the battery. Hence appears more clearly the force of the remarks made above as to the possible influence of even slow motion ahead in producing greater depression of the bow.

that water had not entered even the foremost stokehold up to the moment immediately preceding the commencement of the lurch.

There were a few longitudinal partitions in the fore part of the ship, built primarily for the enclosure of compartments needed for stowage of stores, provisions, &c., and then made water-tight (*see* Plates VI. to IX.). Many of these partitions were inoperative because of damage or open doors. The few which remained intact did not produce such an ex-centric distribution of buoyancy as would have been of any importance, had it not happened that the submergence of the bow so seriously diminished the transverse stability. This statement has been made because, by some persons, the capsizing of the ship has been supposed to have resulted from the presence of central longitudinal subdivisions.

One of the chief causes of the inclination to starboard is to be found in the fact that, owing to open doors, water was able to find its way from bunkers above the protective deck, down through the coal shoot, and so to fill No. 7 bunker (*see* Plate VIII.) just before the forward starboard stokehold.

In Table I. are stated in detail the capacities and transverse positions of the centres of gravity of all the ex-centric compartments which were flooded. In the intact condition of the

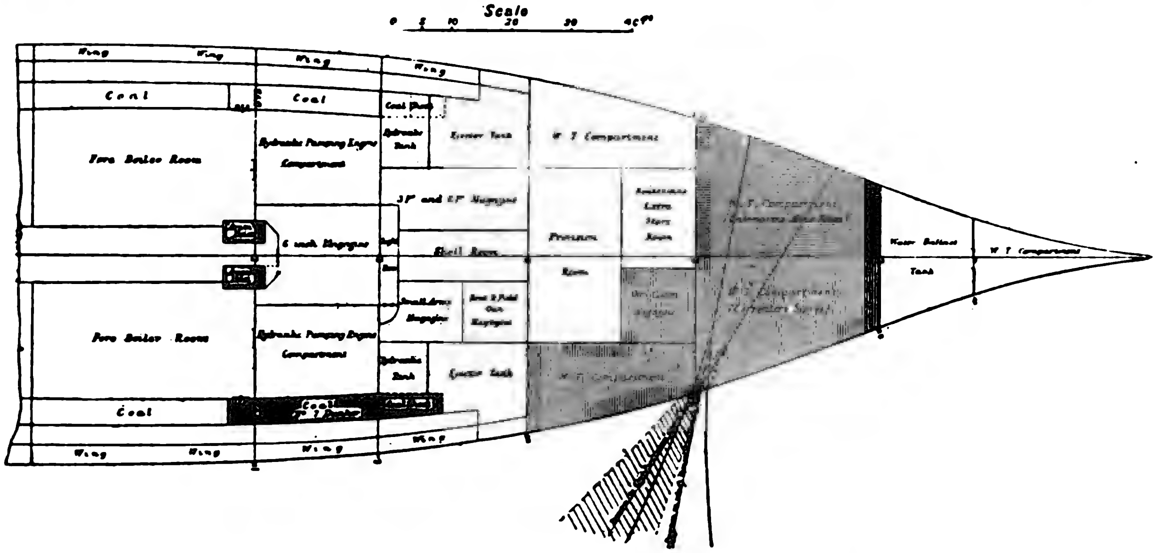


PLATE VIII.—PART PLAN OF HOLD.

NOTE.—Form of bow of *Camperdown* at corresponding level is shown on the Starboard side.

REFERENCES.

The various compartments are shaded to indicate their condition as shown by the evidence.

CONDITION.

Inevitably flooded through damaged side decks and bulkheads.
Subsequently flooded through open doors, hatches, and ports.
These may have been flooded, evidence is not clear.
W.T.D. Indicates a Watertight Door.

The foregoing considerations have an important bearing on the heeling which accompanied change of trim in the *Victoria*. No doubt the primary cause of the heel to starboard must be found in the circumstance that the first rush of water filled very rapidly certain compartments on the wounded side. Subsequently the water found its way into other compartments through open doors or scuttles, or damaged bulkheads, but this, as above remarked, was comparatively a slow process, as is proved by the movement of the ship, both in heeling and changing trim.

Although the water sought to find its level there must always have been a preponderance on the wounded side, and possibly this increased gradually.

In the forward part of the *Victoria* there *is no continuous central longitudinal bulkhead*. That feature does not appear in the vessel except in the stokeholds and engine-room, which were far abaft the place of collision. It is established by the evidence

ship the heel corresponding to the flooding of these compartments would have been only about 5 deg.

As the bow dipped and the transverse stability consequently became reduced, the effect of this inclining moment became greater.

It appears on investigation that in the damaged condition and at the extreme position which the *Victoria* occupied before the lurch began, the flooding of the compartments enumerated and the accumulation of water on the starboard side, account for the observed angle of heel, 18 to 20 degrees.

That lurch commenced, as was explained above, when water rapidly entered the battery in large quantities through the armour door and the broadside gun ports. The effect of the inrush of water was magnified by the great reduction in transverse stability which resulted from the enormous change of trim. Had the door and ports been closed and the entry of water into

the upper deck battery thus prevented, then calculation proves that, sorely wounded as she was, the *Victoria would not have capsized*. Only a short time before the lurch took place, orders were given to close the gun ports, but these orders could not be executed. No attempt seems to have been made to close the armour door at the fore end of the battery. The door and ports were not included in the "Collision Stations," and therefore would not be closed as a part of the drill.

If the *Victoria* had been at sea in bad weather these gun ports and the armour doors would have been closed and secured, so as to maintain the integrity and water-tightness of the high after-part of the ship containing the 6-in guns. In fact, the safety of the ship in heavy weather when rolling through large angles would obviously have required precautions to be taken to keep openings into the 6-in. battery closed, and to keep water out.

Under the actual circumstances of the collision, with the ships moving in smooth water, it was natural that both ports and doors should have been open. But when, by the entry of large quantities of water forward, the bow had been so greatly depressed and the transverse stability so largely reduced, the safety of the ship became dependent upon the exclusion of water from the turret and battery to an even greater extent than pass at a slow rate. Taking the compartments marked b an asterisk in Table I. as a fair measure of the probable extent of damage, then calculations show that the effect of the collision would have been as follows:

(1) The flooded compartments would have been 12 in number, and would have involved a loss of buoyancy of 680 tons: of this loss 600 tons would have been below the protective deck.

(2) The moment producing change of trim corresponding to this loss of buoyancy would have been 90,000 foot-tons.

The change of trim resulting would have been 13½ ft., or less than half that observed before the lurch began. The upper deck at the stem-head would have remained just above water.

(3) The heel to starboard would have been about 9 degrees.

(4) The ship would have retained ample transverse stability, the metacentric height being 2¼ ft.

(5) The forward 6-inch gun ports would have remained 4½ ft. above water.

Under these circumstances the *Victoria* should have been under control and navigable.

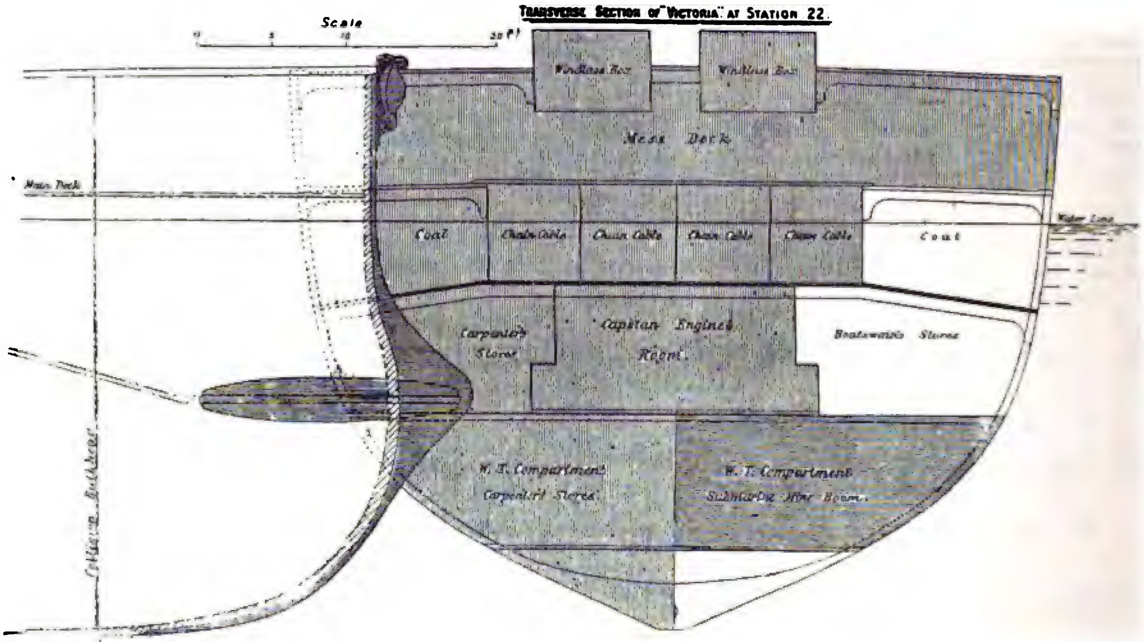


Plate IX.—Diagram showing position of ram of *Camperdown* penetrating the side of the *Victoria*, prepared from the evidence given at the Court Martial.

References.

The various compartments are shaded to indicate their condition as shown by the evidence.

Condition.

Inevitably flooded through damaged side, decks, and bulkheads.

May have been flooded, evidence is not clear.

would have held good when rolling heavily at sea but with full transverse stability maintained.

Consideration has been given also to the probable effect of the collison *had all doors, hatches, &c., been closed prior thereto.* In Table I., as explained above, an attempt has been made to distinguish those compartments which would necessarily have been thrown open to the sea by the collision. Differences of opinion may arise as to the extent to which absolute water-tightness in partitions may have been affected by the shock, but there is obviously an essential difference between serious damage admitting the passage of large quantities of water in a short time, and an interference with absolute water-tightness in bulkheads, decks, &c., which would permit only small quantities of water to

The diagrams in Plate I. have been prepared for the purpose of illustrating the results of calculations made at the Admiralty.

Fig. 1 shows the *Victoria* intact and upright.

Fig. 2 shows her in the position it is estimated she would have occupied after the collision, had the water-tight doors and hatches been closed prior thereto.

Fig. 3 shows her in the position it is estimated she would have reached, had all the compartments enumerated in Tables I. and III. been flooded, but on the supposition that *water had been kept out of the battery and turret.* This corresponds to the conditions illustrated by the upper diagram in Plate II. The estimated change of trim is close to that observed by Captain Moore, and the estimated heel is rather less than that observed. This should

be so as the water was not actually kept out of the battery or turret, and accumulating on the starboard side, must have increased the heel.

Had the battery and turret been kept free of water then even if the *Victoria* had been inclined to 30 deg. from the upright, she would have had a *righting* moment of about 6,000 foot-tons.

On the contrary, when (as actually happened) water could find access to the battery and turret, the stability was destroyed; and at 30 deg. of inclination there would have been an *upsetting* moment of 4,000 foot-tons.

The failure to close the watertight doors in the forward part of the *Victoria*, and the similar failure in the *Camperdown*, has caused suggestions to be made that automatic or "self-closing" doors should be adopted instead of existing arrangement.

This suggestion is a revival of one made long ago, then carefully considered and put aside after certain experimental doors had been tried.

Automatic arrangements are applied in valves to ventilating trunks and other small openings in bulkheads and platforms. Even in such cases the feeling of the Naval Service has led to the automatic fittings being supplemented by the means of closing the valves when desired. In doors and scuttles the risks of the automatic appliances failing to act, or of solid materials being carried into openings by a rush of water, and preventing doors from closing properly, would be much greater.

These considerations have led to the retention of existing fittings, the design of which provides that, when properly closed and secured, doors and hatchway covers shall be as strong as the neighbouring partitions, and watertight under considerable pressure.

There is no mechanical difficulty in making automatic appliances. It is a question of what plan secures the maximum of safety under the working conditions of the Royal Navy.

With large numbers of disciplined men, familiar with the fittings, and constantly drilled in their use, it is possible to close and properly secure all the doors, &c., in a battleship in three to four minutes, or possibly a less time for ships after long periods in commission.

In the *Victoria*, as above stated, no orders were given to close doors until one minute before collision. It is established by the evidence that the doors, &c., were in good order. The failure to close doors, therefore, was due entirely to the insufficiency of the time available, especially in compartments breached by the collision.

Under these circumstances no new argument in favour of the use of automatic doors seems to arise out of the loss of the *Victoria*.

It has been asserted that if a strong armour belt had existed at the place where the blow was struck, the damage to *Victoria* might have been greatly reduced and the ship kept afloat. From the foregoing remarks it is clear, however, that even if the thin belt had been so strong as to absolutely resist penetration, the bottom plating below it must have been very seriously damaged by the spur of the *Camperdown*, and the thin side above it must have been so injured as to cease to be watertight. All the most important compartments which were flooded in *Victoria*, therefore, must have been thrown open to the sea under the conditions of the collision, even if there had been such a belt. The breach in the side might have been different in form and possibly less extensive, especially above water: but it must in any case have been of large extent, and have admitted very large quantities of water in a short time.

Attention has been previously drawn to the fact that the *locking* of the *Camperdown's* bow in the protective deck of the *Victoria* prevented the relative forward movement of the latter ship, and reduced the tearing of the thin bottom plating by the spur of the *Camperdown*. Under the assumed condition of a non-penetrable armour-belt, this relative forward movement and tearing action must have taken place.

The assumption of impenetrability, however, cannot be admitted. It is in the highest degree probable that under a blow of such energy as was delivered on the *Victoria*, the strongest armoured side ever constructed must have yielded and been driven in. Its water-tightness and that of the bulkheads, &c., within it, adjacent to the place where the blow was struck, must have been destroyed, and the ultimate result (as regards the admission of water) would have been practically as serious under the same conditions of open watertight doors, &c., as that which actually occurred in the *Victoria*.

There have been many instances where armour-belted ships have suffered from collision in the manner indicated. In some collisions comparatively light and grazing blows have crushed in and disturbed the water-tightness of the armoured side and of the thin plating below it. In other collisions heavy blows delivered nearly at right angles have produced fatal results on belted ships. As examples, reference may be made to the well-known cases of the collisions between *Vanguard* and *Iron Duke*, and between *Grosser Kürfurst* and *König Wilhelm*.

In the *Vanguard* the armour was driven bodily inwards more than a foot, and the bottom plating below was torn open to the extent of about 25 square feet. This armour was only 6 to 8 in. thick, it is true; but on the other hand the force of the blow was only about two-thirds that delivered by the *Camperdown*, and the ram bow of the *Iron Duke* was not so well shaped for destroying the bottom and wing bulkheads below the armour as was the bow of the *Camperdown*. The point of the spur in the *Iron Duke* projected forward only 2 ft. before that portion of the stem which struck the lower edge of armour in the *Vanguard*. Consequently the spur only penetrated about 3½ feet within the *Vanguard's* side, and did not pierce the inner skin situated about 4½ ft. from the outer bottom plating. Had the *Iron Duke's* bow been shaped like the *Camperdown's* with the spur projecting 7 ft. before the vertical portion of the stem, the spur would have pierced and seriously damaged the inner skin of the *Vanguard*, and that

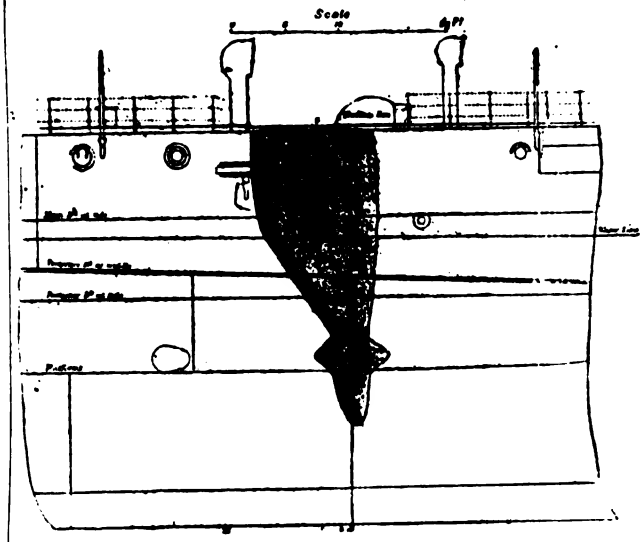


PLATE X.

DIAGRAM showing approximate size of hole in the side of H.M.S. *Victoria*.

ship must have been sunk with much greater rapidity. That she sank so slowly was entirely due to the less efficient form of the ram bow in the *Iron Duke*, and to the slow passage of water into the hold through comparatively small leaks in the unperforated inner skin. Moreover, in the *Vanguard* the blow was struck at a place where the entry of water produced small change of trim; and the very slow rate of inflow of water into the hold—due to the non-perforation of the inner skin—prevented any serious heel.

In the *Grosser Kürfurst* the armour-belt proved equally incapable of saving the ship. As explained above, she was moving at considerable speed across the bows of the *König Wilhelm* when the latter struck her a very heavy blow. This headway, no doubt, produced serious tearing of the bottom plating, and greater damage was done than to the *Vanguard*. The water-tight doors were open and the *Grosser Kurfürst* sank in ten minutes. Some eye-witnesses alleged that she capsized in foundering.

Other cases are on record, but need not be cited, proving that the existence of an armour-belt is no sufficient safeguard against injuries resulting from serious collision.

Summing up the results of the careful inquiry which has been made into the evidence given before the Court Martial, of which

details appear in the foregoing remarks, the following broad conclusions are reached:—

(1) That the interval of time which elapsed betwen the instant when orders were given to close watertight doors and hatchways, and the instant of actual collision (viz., about one minute) was necessarily inadequate for the complete fulfilment of that intention, more especially in compartments forward below the protective deck, and near to the place of collision.

(2) That although every endeavour was made to close the water-tight doors subsequently to the collision, the doors and hatchways which are proved to have remained open, permitted water to pass into compartments adjacent to those breached; and consequently greatly increased the loss of buoyancy, the depression of the bow, and the diminution of transverse stability.

(3) That, so far as can be judged, had all doors, hatchways, &c., been closed prior to the collision, the *Victoria* would have continued to retain ample buoyancy and stability, and would not have ceased to be under control.

(4) That, under the actual circumstances of the collision, and with the doors remaining open which have been enumerated above, it was inevitable that the vessel should have attained the position described by the various witnesses as reached before the lurch began; with her bow buried about 13 ft. below water and with a heel to starboard of about 18 to 20 degrees.

(5) That, even when so seriously injured and brought to such a critical condition, had the ports in the turret and upper-deck battery been closed, the armour door secured and water excluded from turret and battery, the *Victoria* would not have capsized. It is possible that she may have eventually foundered in consequence of the gradual passage of water into compartments, respecting which the evidence leaves us in doubt.

(6) That, under the serious circumstances of this collision or of any similar accident which may occur, the safety of a ship and her continued flotation demand that provision should be made for closing gun ports and openings in upper works, through which water may pass into the interior of the ship, if the flooding of compartments produces great change of trim or serious heeling.

If such precautions are not taken the virtual height of freeboard is reduced to the height of the sills of ports or doors; and the presence of the superstructures, when water is not excluded from them, does not assist either buoyancy or stability to a sensible extent.

15th September, 1893. W. H. WHITE.

THE FLEETS OF THE MAIL LINES.

THOUGH a line of considerable age—it maintains a service inaugurated upwards of thirty years ago—the West India and Pacific Steamship Co. does not make much show in the columns of the daily press. It is a thoroughly well-managed concern, and could show some of the more pretentious companies a few wrinkles in tactics. It now possesses a thoroughly modern fleet, for those who direct its affairs have seen that when a vessel becomes antiquated and loses her potentiality for earning money the sooner she is parted with the better. Though the earning power may go the spending power remains, and in repairs and charges she soon eats her head off. Better to take the market price of old iron than to go on paying dock dues and shipkeeper's wages. At the present moment the *Haytian* is on sale, and the oldest other vessel in the fleet was launched in 1880. They have no less than nine modern steamers with triple-expansion engines, and they have two of these fitted with boilers to carry the highest working pressure (200 lbs.) at present found on the Atlantic.

What, however, brings the line under notice at present is the salvage of life recently effected by its captains. On the 26th October, Captain Highton, of the s.s. *Yucatan*, was the recipient of a work of art, handed to him by the Liverpool Local Marine Board, on behalf of the French Government, as an acknowledgment of his skill and humanity in effecting the rescue of the crew of the French barque *La Petit Bourgeois* in mid-Atlantic, during a December gale, when such a sea was running that the steamer's boats could not approach the wreck, and the 15 men had to be drawn from the barque by lines. Meanwhile, Captain Norton Alexander, of the company's s.s. *Mexican*, was qualifying himself for a similar presentation from the United States authorities. Homeward bound from New Orleans on the 16th October, something unusual was sighted on the starboard bow, and on making for it, it was seen to be a signal of distress from a waterlogged American schooner.

On the afterdeck house were huddled together six men and a young and delicate woman. These Captain Alexander took off, and brought to Liverpool. The credit here is due not so much for his humanity and skill—it is to be hoped that any captain of a British ship would do as much in like case—as for his altering his course to make out the object sighted. We have heard so much lately of the anxiety of the officers of passenger steamers to get on with their voyage, which laudable in itself, induces them to ignore signals. What would have happened to these poor people if Captain Alexander had been one of these and said, when an unknown object was reported, "It is probably some old derelict; keep her on her course," is a subject too terrible to dwell upon.

The Union Co. have made their old steamer *Moor* into something not far from the best of the combined South African fleets. She has been lengthened by Messrs. Thomson, of Clydebank, and given additional power; her engines were already tripled in 1888. Her new speed remains to be seen when strikers cease from troubling, but her dimensions are now considerable. Her length is now 420 ft., just that of the s.s. *Dunottar Castle*. But the directors are by no means content with this. They have given an order for a new twin-screw mail steamer to Messrs. Harland & Wolff. The vessel is to bear the name of *Norman*, which has historic associations for the line. It was one of the earliest names of their fleet, and if the new ship is anything like as good an investment as the old *Norman*, the Union shareholders are to be envied. The published accounts of the new vessel lead to the conclusion that she is to be some 600 tons bigger than the *Scot*. The length is to be about 15 ft. greater, but the beam is to be some 18 in. less. The depth remains the same. Nothing is volunteered as to engines and speed, but we may rest assured that Belfast will have a good try at beating Dumbarton in the race to South Africa unless indeed the specifications are for a steamer of a slower class, which, under the circumstances, is very improbable.

The *Nevada* was not sold on the 2nd November, only £3,400 being bid. She has since, however, been privately sold for about £4,000. Meanwhile, the Guion Line (by the way "McGuin" was printed last month for "Mr. Guion") is stating a winter service of steamers from Liverpool, direct to New York. The Leyland liner *Virginian*, sailing on the 4th November, is a 4,000 ton cargo boat, built by Palmers' in 1881.

Sales of old steamers continue, but prices are not very encouraging. The *Africano*, sold at the same time that the *Nevada* was withdrawn, only fetched a fraction over a pound a ton. She is certainly 28 years old, and has probably been allowed to run down considerably since her original owners disposed of her, but at such a price the ship-breaker should make a very handsome profit.

The Orient Line has taken honours at the Cookery Exhibition for its arrangement of a saloon table, and for its exhibit of provisions. An increased attention to this point is a wise move. Menus have long been attended to on board ship and *on paper*, the saloon meals have been beyond improvement. The unfortunate thing has been that everything tasted alike. The healthy appetite of the sea has prevented grumbling for "the best sauce" makes us always ready to eat on shipboard. If well-cooked food is to be the rule, fares will certainly have to be raised to pay for the increased consumption.

The Compagnie Generale Transatlantique has achieved the distinction of bringing the first twin-screw stramship into the West Indian and Mexican trade. This vessel is the long-promised *La Navarre*. She is a schooner-rigged two-funnelled boat, of some 8,930 tons displacement when loaded. Her length is about 493 ft. and her beam 49 ft. The two sets of triple-expansion engines are separated by a longitudinal bulkhead, and this with some thirteen transverse bulkheads divide her into fifteen compartments. She has four decks and a promenade deck, the latter being 230 ft. long.

Her engines developed some 7,500 H.P. on trial, and drove her at a speed of 18 knots. The cylinders are 31½ in., 50½ in., and 82½ in. in diam., with a stroke of about 52 in. There are four double-ended boilers, with a total of 24 furnaces. The draught is provided by four ventilating fans. The screws are of gun-metal, 15½ ft. in diam. The passenger accommodation provides for some 200 saloon, 54 steerage, and 74 third-class passengers, whilst the lower deck can be fitted for 600 fourth-class passengers on occasion. The vessel is, of course, available to her Government as an auxiliary cruiser in wartime. Captain de Kersiabiec has been appointed to her command, and she will doubtless lower the record in

due course. After her first voyage has been completed further particulars will probably be available, and her performances will be awaited with interest.

The sale at the end of November, by Messrs. John Hughes, will include a once well-known steamer. She will be offered as the *Exmouth*, a name she has born for some years. That name is likely to keep her memory green, for she was the subject of some litigation whilst she bore it. Previously she had sailed under the Anchor flag as the *Scotia*, and at the commencement of her career, in the sixties, belonged as the *Weasel* to Messrs. Burns' fleet.

Speaking of this vessel brings us to the Anchor Line, and it is well to remark in passing that the Duke of Devonshire, who retained a large interest—amounting in some cases to as much as fifty per cent.—in the vessels built for the line by his firm at Barrow, has sold his shares to the managing firm in Glasgow. Whether this arrangement includes His Grace's interest in the s.s. *City of Rome* appears doubtful.

The *Daily News* is responsible for a very remarkable tale of the sea. It appears that in 1866 an outward bound sailing vessel, named the *Empress*, went ashore at the mouth of the Mersey. She had a valuable cargo of machinery, which fortunately was constructed of imperishable brass. Before any salvage of importance could be made, the vessel was swallowed up by the sands on which she lay. That seemed the end of the tale in 1866, but it has recently occurred to the quicksand that it cannot digest brass and copper, and so, having no further use for it, it has disgorged it and returned as much as it could for the benefit of the underwriters on the cargo. This honesty of a quicksand certainly deserves the publicity which the *Daily News* has given it, and perhaps now we call attention to the fact that it has not paid interest during all these years, it will rectify the omission.

It is an ill wind that blows no one any good. The breakdown of a couple of Indian troopers at the busy season has necessitated the chartering by the authorities of the Cunarder *Bothnia*, and she omitted her voyage to Boston on the 16th November, and is to start for Bombay on the 2nd of December. This will be a welcome substitute for the troops, and it is possible that an offer of employment at remunerative rates for a fairly large steamer in the winter will not be unacceptable to the Cunard shareholders, for they will have apparently a large number of expensive vessels lying idle. There is little inducement at present to send extra boats across the Atlantic, for the passenger trade seems to be suffering from unexampled depression.

At the time of writing, the terrible gale of November, 1893, seems to have left "the fleets of the mail lines" untouched. We have had indeed many great liners late, and have heard of a passenger's leg being broken, but there the casualties yet reported seem to end. The poor old *Helvetia*, however, whose sale to Marseilles owners has already been recorded, was bound down channel when the storm caught her and her machinery gave out. She was fortunately towed into Milford. Under the circumstances it may be better to merely note the fact and leave comment for a future occasion. Another old National liner, the *Canada*, has been in trouble. She has been put away in Stangate Creek on the Medway for some months, and a serious fire has occurred on board her, owing apparently to spontaneous combustion in her bunkers. Thanks to the proximity of the Royal Dockyard, substantial aid was quickly obtained, but the fire would seem to have done a good deal of damage.

The *Himalaya*, which arrived at Plymouth on the 22nd November, has reduced the passage from Bombay to Brindisi to 10 days and 20 hours. She now holds the record in each direction.

The Phosphor Bronze Co., Limited.—We have been asked to state that the Phosphor Bronze Co., Limited, of 87, Sumner Street, Southwark, London, S.E., for the convenience of clients in Scotland, and to save them the heavy carriage in parcels from London, have appointed Messrs. Dempster, Moore & Co., of 49, Robertson Street, Glasgow, their sole agents in Scotland for the sale of the following goods of their manufacture, viz.:—Phosphor bronze alloys, Duro metal (for bearings), plastic metal and white brass, Babbitt's and other white antifriction metals, Bull's metals (for propellers, forgings, and stampings), Manganese bronze, phosphor tin, and phosphor copper. These sole agents will keep a small stock of some of the aforementioned metals at their warehouse, 49, Robertson Street, Glasgow.

THE FASTEST VESSEL IN H.M.'S NAVY.

We have the pleasure to record the successful official trial on Saturday, October 28th, of H.M.S. *Havock*, built by Messrs. Yarrow & Co. This trial was looked forward to with more than usual interest, the *Havock* being the first of twelve similar vessels of an entirely new and distinctive type, which are being built by private contract for the British Admiralty. They have been designed by Mr. W. H. White, Director of Naval Construction, with a view to be superior to other fast vessels building by foreign powers, who, it is well known, have made great advances of late in the construction of such vessels. The name given to this new type is that of "Torpedo Boat Destroyer." They are intended to act against torpedo boats, and to have a speed superior to that possessed by such craft at the present time, and, what is of the highest importance, to be capable of maintaining that speed at sea in which torpedo boats have been found to be sadly deficient. Their coal-carrying capacity will enable them to have a radius of action far greater than the present torpedo boats, and to test by practical experience how far the *Havock* can operate from a base, a further slow speed trial is to take place. The trial on Saturday consisted of a three hours' continuous full speed run at the mouth of the Thames, carrying a load of 35 tons, when it was found that the contract speed of 26 knots was exceeded. The Admiralty authorities expressed themselves highly pleased with the result of the trial, not only on account of this excellent speed being obtained, but because it was secured with the greatest possible ease, and it was evident to all on board that Messrs. Yarrow & Co. had at least another knot in reserve. The country is to be congratulated upon shortly possessing a fleet of such vessels, which in the event of war could not fail to be of immense value.

The new torpedo boat destroyer *Havock*, built by Messrs. Yarrow & Co., was again taken out on Friday, November 3rd, for an eight hours' trial at an economical speed, with a view to ascertain the distance she would steam with the fuel supply she can carry on board, upon which depends her radius of action. It was found that at a speed of 11·2 knots the consumption was under a quarter of a ton an hour, and at 10 knots 3½ cwt. an hour; and as the bunkers have a capacity of 60 tons, it follows that the distance the *Havock* can steam without coaling is about 3,500 knots. At the recent full speed trial, loaded, she covered over 78 knots in three hours, in very boisterous weather; and during one part of the trial the speed exceeded 27 knots, that is 31 miles an hour, which is certainly a wonderful performance. The Admiralty authorities consider this new vessel a very great success in every respect. The *Havock* will now be provided with a few remaining fittings, and she was expected at Portsmouth the end of last month.

A SAFETY LAMP FOR SHIPS' HOLDS.

The necessity of some thoroughly safe and efficient light for the holds of vessels carrying inflammable cagoes is so generally recognized that any step in the direction of meeting these requirements will be of interest to our readers. Recently we came across a special form of lamp designed by Messrs. Johnson, Clapham & Morris, Limited, of Manchester, which, although primarily intended as a light to be used in the roadways of mines, possesses special features and advantages which must recommend it as exceptionally adaptable for vessels carrying petroleum oil, the stokeholes of steamers and ships generally, conveying inflammable cargoes. This lamp, of which we give an illustration, is really an extra large size of the ordinary Marsaut or Mueseler type of safety lamp employed in mines, with the addition of a reflector, and so constructed that it throws down an efficient light for ordinary working purposes. Amongst the special features of the lamp, in addition to the well-known safety of the Marsaut and Mueseler type of safety lamps, is a patent metallic-ringed safety

gauze, which renders the lamp less liable to damage in rough usage than those of the ordinary construction. In the Stephenson gauze, which is stitched at the seam instead of folded, as in the ordinary gauze, the mesh is often enlarged where the stitching wire passes through, and objection is frequently raised to the Stephenson gauzes for this reason. The metallic seam introduced in Johnson, Clapham & Morris' improved gauze obviates this and strengthens the gauze, so that it cannot be torn asunder, and another advantage is that whilst a folded seam is easily crushed open by

rough usage, and the lamp thus rendered useless, the metallic seam may be crushed or bent in any way, but can never open. This enlarged safety lamp gives an excellent light, and sufficient for all working purposes either in the stokehole, the hold of a petroleum steamer, or any part of a vessel, and as it is absolutely safe in contact with any inflammable gas, it is a lamp which might be found very serviceable on numerous vessels and steamers which are not supplied with the electric light.

Good News for Stockton.—We understand that Messrs. Craig, Taylor & Co., of the Thornaby Shipbuilding Yard, have secured another order for their old friend, Mr. J. S. Barwick, of Sunderland, for whom they have built a number of oil vessels.

TRIALS OF H.M.S. "SPEEDY."

THE new first-class torpedo gunboat *Speedy*, which was built and engined by Messrs. John J. Thornycroft & Co., and the launch of which from their shipyard at Chiswick on May 18th last, we noticed in our June number, has during the past two months been undergoing an exhaustive series of trials off the Nore, in order to test more especially the capabilities of the new type of boilers with which she has been fitted by her builders, and which were guaranteed to develop under forced draught 1,000 I.H.P. in excess of that promised by other contractors in vessels of the same class and size.

As the speed and boiler trials of the *Speedy* promised to be of exceptional interest, a large and representative body of gentlemen attended them, which included Captains Le Clerc, Gülich, Leopold von Jedina, and Coles, Naval Attachés to the French, German, Austrian, and American Governments respectively; Geheimrath Langner, Engineer-in-Chief, German Admiralty; Baurath Beck, Chief Engineer of Torpedo Department, Kiel; Captain Fassel, Engineer-in-Chief, Austrian Navy; Captain Alfonsi, Royal Italian Navy; Captain Barandon, Chief of Torpedo Department, Kiel; Herr Blackstady, of Messrs. Möller and Holberg, Grabow-a-Oder, Stettin; with several officers of her Majesty's Navy and other interested visitors. The Admiralty officials present included Mr. Deadman and Mr. Pledge, of the Constructor's Department, and Mr. Oram and Mr. Butler, engineer inspectors. Sheerness Dockyard was represented by its chief and assistant engineers, and the Steam Reserve by Fleet Engineer Moon, R.N. Mr. John J. Thornycroft and Mr. J. Donaldson were present on behalf of the contracting engineers and builders of the *Speedy*, the former of whom took charge of the machinery. Lord Charles Beresford, C.B., had special charge of the trials.

After a preliminary run on September 28th to test connexions and see that all was in readiness, the vessel, under the command of Captain Douglas, R.N., of the Steam Reserve, left Sheerness on October 3rd for a trial under natural draught. The boilers having been filled with Sheerness water, steam was got up in them to a pressure of 200 lb. per square inch in from 25 to 30 minutes from the time of lighting fires. At 7 a.m. the vessel left her anchorage, and on arrival in sufficiently deep water steaming was begun and continued for eight consecutive hours, with the following mean results:—With an air pressure of ·58 in. in the stokeholds steam was maintained at a pressure of 183·3 lb. per square inch: and with a vacuum of 27½ in. the engines attained a speed of 206·4 revolutions per minute, and developed a total of 3,043·7 I.H.P., 1,438·2 of which was given off by the port engines and 1,605·5 by the starboard; the resultant speed of the ship—the mean draught of which was 9 ft. 8¾ in.—being 18¼ knots by log.

It having been deemed advisable that on the further trials of the vessel distilled or fresh water should be used in the boilers—on account of the deposit found in that obtained at Sheerness—this was supplied, and some modifications having in the meantime been made in her steering gear, she on October 20th, at 8 a.m., left Sheerness for a preliminary trial under forced draught. After some hours' admirable steaming on the part of the boilers and good running of the engines, the latter during part of the time indicating 4,390 H.P., with the vessel making 20 knots, one of the starboard engine crank pins was found to be heating, and it was decided after its stoppage and examination to relinquish the trial for the day and return with the ship to Sheerness. The run back brought out the advantages of the twin-screw system of propulsion, for, with very easy steaming on the part of the boilers and one set of engines only in use, the vessel averaged over 11 knots for the three hours taken in covering the distance over which she had to return to her anchorage.

At 8 a.m. on October 26th the *Speedy* again left her anchorage at Sheerness and proceeded to sea to undergo the official three hours' full-power trial under forced draught. As some 40 miles had to be covered before getting into deep water, an opportunity was afforded of noting how easily the boilers responded to the demands made upon them for steam, as the speed of the engines and vessel increased up to the time of reaching the trial ground and setting the log. After running for four consecutive half-hours—in which, with steam at 200 lb. pressure per square inch, and the engines making 245 revolutions per minute, 4,564·5, 4,674·6, 4,685·9, and 4,708·1 I.H.P. respectively were developed by them, with a resultant speed of ship of 21 knots—it was found while running the fifth half-hour that salt water was finding its way into the boilers, owing to a valve having been left open by mistake, whereupon it was decided to return to Sheerness.

The final official trial of the ship was completed on Tuesday, November 7th, in very rough weather. Leaving Sheerness at 8 a.m., she proceeded to sea, and at 9.30 a.m. started on a continuous run of three hours' duration under forced draught, when the following mean results were attained:—With an air pressure of 1·7 in. in the stokeholds a steam pressure of 198·6 lb. per square inch was maintained in the boilers with easy firing; the starboard engines with a vacuum of 27½ in., and the port ones with 27 in., made 247 and 243 revolutions per minute respectively, and developed a total of 4.674·7 I.H.P., giving the ship, which was drawing at the time 7 ft. 5 in. forward, and 11 ft. 9 in. aft, a speed of 20 knots in a heavy sea. Throughout the run the boilers showed no tendency to prime, and had a greater fan power been used, it was evident from their working that they were capable of developing a much larger power than that given out by them at Tuesday's trial.

The *Speedy* is of the same general dimensions as the other vessels of her class ordered to be built under the Naval Defence Act of 1889, her length being 230 ft. between perpendiculars, beam 27 ft., and displacement at load draught of 8 ft. 9½ in., 810 tons. She has been fitted by her builders with triple-expansion twin-screw engines to develop 4,500 I.H.P. under forced draught, and 2,500 under natural draught, the steam for which is generated in eight of Messrs. Thornycroft's patented water-tube boilers, the first of the kind fitted to any vessel in the British Navy, having a total heating surface of 14,720 square feet, and a grate surface of 204 square feet. The special feature in this type of boiler being the generation of steam from water contained within instead of outside of a number of tubes of comparatively small internal diameter, nearly the whole of the heat given off in the combustion of the fuel is absorbed by the tubes and utilized, and there is no unnecessary carriage of water within the boiler not required for steam generating purposes, as in the ordinary marine or locomotive types of boilers usually fitted, the weight of the Thornycroft boilers fitted in the *Speedy* when full, being some 20 tons less than those of ordinary type fitted in gunboats of the same class. With this decrease in the weight of the boilers, there is in the *Speedy* the further advantage of increased stoking space, and ample room for examining the tubes, although the boilers are eight in number, instead of four, and are allowed only the same space in the ship as other vessels of the same class and size. During the exhaustive trials, the *Speedy* has undergone the temperature of the stokeholds under natural draught—they are cooler under forced draught—has never exceeded 100 deg.; accounted for by the fact that all the heat developed by the combustion of the fuel is absorbed by the steam-generating tubes of the boilers, and is prevented by their specially peculiar arrangement from passing to the outside and causing a radiation of heat therefrom into the stokeholds.

From the results attained on the trials of the vessel, the advantages claimed for the water-tube boilers fitted to her by the inventor have been fully realized, the following points having been specially brought out while they were under trial. The ease and rapidity with which steam can be raised to any pressure within the limit for which the boilers are constructed was shown in the short time required to raise it. The exemption from leakage was evidenced by the behaviour of the generating tubes under the extreme ranges of temperature and pressure to which they were subjected, and from priming by the energetic circulation of the boiler water, effected by the special arrangement of tubes adopted. There was also an entire absence of the ejection of either flames or unburnt fuel from the funnels, from the small amount of forced draught required, and the large and effective heating surface causing nearly all the heat developed by combustion to be given off by the waste gases before they enter them.

The complete success of the above recorded series of trials of the Thornycroft water-tube boiler, a success which all who witnessed them fully and highly appreciated, would seem to infer that, when certain slight modifications of detail which have suggested themselves during the trials have been made in future boilers of the same type, we may look before long for a revolution in the art of fitting our war and commercial ships with steam generators.

Considering that the *Speedy's* boilers on the above-recorded trials have been stoked by Navy stokers with no previous experience of the Thornycroft boiler, the results attained must be considered as eminently satisfactory, it being asserted by many that good results on such trials can only be obtained by stokers trained by the contractors, and that such results are never repeated by Navy stokers. As a matter of fact, the stokers engaged at the *Speedy's* trials not only found no difficulty in managing the boilers, but reported that it was much easier to fire them than either marine or locomotive boilers having an equal size of grate.

LAUNCH OF THE NEW ATLANTIC STEAMER "KENSINGTON."

THERE was launched on October 26th, from the shipbuilding yard of Messrs. James & George Thomson, Limited, Clydebank, the *Kensington*, a twin-screw steamer of about 9,000 tons, built for the International Navigation Co. Her dimensions are:—Length between perpendiculars, 480 ft.; breadth, moulded, 57 ft.; and depth, moulded, 40 ft. The vessel, which is throughout of Siemens-Martin steel, has a straight stem and an elliptic stern. She is in all respects at least up to Lloyd's requirements, and is in addition subdivided by nine watertight bulkheads, which are in accordance with the recommendations of the Bulkhead Committee. A double bottom on the cellular principle, available for water ballast, extends the full length of the ship. The appliances for pumping are of the most modern description, and by a special arrangement the water can be pumped from one tank to another for the purpose of trimming the ship. The arrangements for freeing the bilges of water are also very complete, and in addition large ejectors in the engine space, which, being controlled from the upper deck, can be set to work even in the event of the pumps being disabled or submerged. The vessel is to carry 8,000 tons at a draught of 28 ft., and is fitted with very complete arrangements for handling cargo expeditiously. There are in all ten powerful steam winches of Messrs. Clarke, Chapman & Co.'s most improved make, near the hatches on upper deck, and worked in conjunction with strong

derricks, of which there are no fewer than 16, of lengths varying from 40 to 60 ft. There is an extensive installation of refrigerating machinery in separate sections—one for perishable cargo and the other for the ship's requirements. In connection with the latter there are large ice-houses and store-rooms on the main deck on the principle adopted by Messrs. Kilbourn & Co., of Liverpool, who are the makers of the entire refrigerating plant. Although intended as a first-class cargo-carrying steamer, the *Kensington* has accommodation in large state-rooms amidships on the upper deck for about 120 passengers, as well as for the officers of the ship; and on the bridge deck above is the dining-saloon, a well-lighted, commodious apartment in polished oak, which is seated for 126 persons. This apartment is entered from either the bridge deck or from the upper deck by a wide staircase. The ladies' room is on the bridge deck on the port side of the boiler casing, and is entered from the saloon vestibule. At the after end of the same deck is a comfortable and well-appointed smoking-room. Above the dining-saloon is a strong steel house containing captain's room, chart and wheel houses, and a number of first-class special state-rooms; and surmounting the whole structure, at a height of 44 ft. above the water when the ship is loaded, the navigating bridge. Accommodation for the crew is provided under the forecastle, and there is provision under the poop for a large number of cattlemen, in the event of cattle—for which suitable arrangements have been made—being carried. There is, in addition, accommodation on the main deck for over 1,000 emigrants, and great care has been bestowed on the ventilating, heating, and sanitary arrangements of these particular spaces. The vessel is steered by a very large single plate rudder, the weight of which is carried inboard, there being no bearing pintles in the rudder frame. The rudder is actuated by Messrs. Brown Brothers' patent steam steering gear, working direct on to the rudder head, and controlled from the bridge by Messrs. Brown's patent telemotor gear. Strong relieving tackles are also fitted to the tiller. The appliances for handling the ship are of the most powerful and modern character. A very strong windlass of Clarke, Chapman, & Co.'s latest pattern is mounted on the forecastle for working the anchors. It is provided with large warping drums, so that a separate warping capstan is not required, and the hawse pipes are made large enough to stow the anchor stocks in them if so desired. A powerful double-geared steam winch is mounted on the poop for warping, and the leads for the steering gear relieving tackle are also taken to this winch. The ship is to be lighted throughout by electricity, the installation of engines and dynamos being by the builders' electrical staff. Elaborate arrangements have been made for extinguishing fire. There are powerful fire-engines with connections to all the compartments on the main, upper, and bridge decks, in addition to the steam extinguishers fitted to all the holds, in accordance with American Board of Trade requirements. A full complement of boats all stowed under davits is carried, as well as the other life-saving appliances required by the Board of Trade. The ship has four steel pole masts, rigged fore and aft, and one large oval funnel. The engines are of the direct-acting, surface-condensing, quadruple-expansion type, with four cylinders working on four cranks. The cylinders are 25½ in., 37½ in., 52½ in., and 74 in., and the stroke 4 ft. 6 in. The boilers are designed for a working pressure of 200 lbs. per square inch, and are fitted with Messrs. Brown's induced draught and "Serve" tubes. The launch took place shortly after noon, Miss Maria Sinclair Spence performing the christening ceremony. Afterwards the builders entertained the launch party to lunch in the model-room. Mr. James R. Thomson presided, and amongst those present were Mr. J. Parker Smith, M.P.; Captain Sinclair, M.P.; Mr. James Spence (of Messrs. Richardson, Spence, & Co., the managing owners in Britain of the International Line); Miss Maria Sinclair Spence, Mr. George P. Thomson, Captain Lewis, Mr. J. Thom, Mr. Jamieson, Mrs. J. R. Thomson, Mr. F. Worth, R.N.; Mr. G. T. R. Cumming, R.N.; Captain Buckler, Mr. Peskitt, Captain Griffin, Mr. Barr, Mr. F. Kerr, Sr. don Floriano Rios, Sr. don Tonbio Gil, Sr. don Ramiro Perez, Mr. C. Du Sautoy, Sr. don Manuel Eszaguirre, Mr. Coleman, Colonel Nightingale, and Miss Nightingale. The chairman, in proposing "Success to the *Kensington*," said that was not the first ship they had built for the International Co., and not the first time Mr. Spence had been in Clydebank. The Americans now wished to do a great deal for the company, but notwithstanding the fact that they did, he hoped there would still be a little left for Clydebank; for they were prepared to do just as much in the future for them as they had done in the past. He believed that the *Kensington* would be remunerative, and that was the essential of a good ship from the builder's point of view; for if a production did not make money, its owners seldom went back to the constructor for more. Mr. Spence, who replied, also proposed "The Builders." He said the ship they had just seen launched would turn out, he believed, as satisfactory as any the firm had ever built. She was not intended as a racer, but for the Philadelphia servic e, to carry large cargoes and accommodate in a superior manner a limited number of passengers. She would be able to hold her own with any ship of her class on the Atlantic, and be as successful financially as some of the bigger and faster boats. Mr. George P. Thomson, in replying, said that in the *Kensington* they had given Mr. Spence and his company the best ship they possibly could. He had not the slightest doubt that the ship would be quite up to the standard of the other boats built at Clydebank for the same owners. The health of Miss Spence was proposed by the chairman.

WATER-TUBE BOILERS IN THE NAVY.

WE publish this month the very successfu trials made with the new type of water-tube boiler fitted in her Majesty's ship *Speedy*—the last of the torpedo gunboats ordered under the Naval Defence Act—by Messrs. Thornycroft, of Chiswick. The experimental trial of a new boiler on the same principle, but of a different type, it being one of eight similar boilers under construction by Messrs. Yarrow & Co., of Poplar, for the new torpedo-boat destroyer, the *Hornet*, now building by that firm for the Admiralty at their shipyard at the Isle of Dogs, has taken place in the premises attached to the shipyard. It was a crucial test of the capabilities of Messrs. Yarrow's latest improved type of water-tube boiler. The *Hornet*, which is sister ship to the *Havock*, by the same builders, will have the same kind and size of engines as her consort, and to effect as large a success in the matter of speed must have equally as powerful boilers, of whatever type they may be, but occupying no more space in the vessel. These, it is believed, are the *minimum* conditions of the contract. The boilers of the *Hornet*, although of the water tube type, differ materially in the arrangement of their component parts, and, for simplicity of design and construction, will compare favourably with any on the same principle which have preceded them. The one under trial last month has 1,027 sq. ft. of tube-heating surface and 20·6 sq. ft. of grate surface, the length of fire-bar being 6 ft. 6 in. To test the boiler under the worst conditions of working, it was placed in the open without shelter and exposed to the fog which prevailed on the day of trial. In the presence of several engineering experts who were in attendance, the boiler, filled to its proper working height with cold water of the temperature of the surrounding air, had its fire lit at 2.20 p.m.; at 2.30 p.m. the steam-gauge pointer began to move; at 2.36 p.m. the gauge showed 60 lb. pressure of steam; at 2.40 p.m. 100 lb.; and at 2.42 p.m. a pressure of 180 lb. per square inch was registered. The boiler not being in any enclosed space, to produce the same effect on the fire as obtains in the application of forced draught on shipboard a steam blast, as in an ordinary locomotive, was applied in the funnel. This was put on at 2.40 p.m., when the gauge indicated 100 lb. pressure, so that in two minutes after its application the pressure increased 80 lb. per sq. in. The blast being under entire control, the air pressure used could be ascertained with exactness, and from the readings of the gauge did not exceed 3½ in. From 2.42 p.m.—two minutes after putting on the blast—until the conclusion of the trial at about 3.20 p.m., steam was maintained, and was blowing off at the full pressure of 180 lb. per sq. in., showing that a much less pressure of air than was used an ample supply of steam at that pressure could be relied on. As a crucial test of its effect on the construction and the fitting of the tubes of the boiler, the fire (which was in a glowing state at the time) was at 3.20 p.m. as quickly as possible withdrawn, and every access for the surrounding air to reach the interior of the furnace allowed: but on examination not the least sign of a weep or anything approaching it from any of the tubes was perceptible, a fair proof of excellent workmanship and the soundness of the principle upon which the boiler is designed.

The boiler is in form and construction so exceedingly simple, yet, at the same time, so novel, that we may fitly conclude our notice of its trial with such a description of it as should be

understood by all our readers. In form, looking at it from the front, it is like the Roman capital letter A, surmounted by a circle at the point where the two sides of the letter meet. The circle is a cylindrical shaped vessel or chamber, some 7 ft. 6 in. long, into which the two sides of the letter, which are a series of small copper tubes 1 in. in diameter, penetrate; the lower ends of these being fitted into the serifs or feet of the letter which in the boiler are semi-circle bottomed chambers. The cross-bar of the letter—but lower down than in it—would represent the fire-grate bars. Here we have the whole boiler. Water is pumped into the upper cylindrical chamber, flowing down and filling the side legs or tubes, and is continued until the upper chamber is nearly half full. The fire is made on the crossbars between the side legs, and the flame and radiant heat, passing in among the tubes, boil the water in them and convert it into steam, which rises in them to the surface of the water in the upper chamber and is there collected and confined until required for use. The circulation of the water—which is the *bête noire* of all ordinary boilers—is here absolutely perfect; the rows of tubes nearest the fire acquire the greatest heat, and the water in them is in consequence made sensibly lighter and ascends, while that in the outside rows, being cooler, and therefore heavier, follows the natural law and descends, and takes the place of the previously heated water, thus keeping up a continuous movement and circulation of it.

In confirmation of this efficient circulation of the water in the boiler under description, the evaporation in it on the trial was calculated to have reached 12,500 lb. of water per hour, or 100,000 lb. for the eight boilers to be fitted in the *Hornet*. A comparison of this with the two locomotive boilers of the *Havock*, whose evaporation was 54,880 lb. per hour, her engines indicating 3,400 H.P. would give the boilers of the *Hornet* a power equal to 6,250 I.H.P., an amount largely in excess of what would ever be required from them.

Comparing the weights of the two sets of boilers, those of the *Havock* when full weighed 54 tons, while the *Hornet's* complete, with all fittings, will not exceed 43, or a saving of 11 tons, which in vessels of the class is considered by the naval authorities an item of first importance, the First Lord of the Admiralty having only recently declared that high speeds in such vessels could not possibly be attained except by the use of engines and boilers which would give the maximum of power on the minimum of weight. With this expression of opinion, the results of the above recorded experimental trial of Messrs. Yarrow & Co.'s new water tube boiler seem to be in accord, and the patentees may be congratulated on having attained so great a success in modern marine engineering.

A NEW STOCKLESS ANCHOR.

WE have pleasure in placing before our readers particulars of a newly-introduced stockless anchor, which we have no doubt will ere long become an object of much interest to shipowners. The most striking feature of the new anchor is that it has *four* gripping or holding points, which give it twice the amount of effectiveness in action as compared with anchors having only two gripping points or palms. The utility of a second pair of holding points does not end here, however, for the "tripping arms" in this anchor, which are placed one on each side of the centre, or head of shank, materially assist in preventing the anchor from canting over when, in striking the ground, the main arms are being "tripped" into penetrating position. A further security against canting is provided in the elbows on the main arms, and a glance at the illustration will show that with this anchor such an occurrence is almost impossible. When in action, the "tripping arms," rest on the neck of the shank, forming with the quadrant in the head, an effective *double* stop. In the event of the very remote possibility of any damage occurring to the centre arms, the double stop or quadrant referred to, will secure the main arms, at the proper angle, thus giving doubly increased security in action and holding power. In this anchor no space is left at the junction of the main arms with the head of shank, wherein mud or small stones might accumulate, with the disastrous result of preventing the main arms from turning into penetrating position at the crucial moment. This is what is called "choking," and the patentee has taken very effectual means of guarding against such an accident. It may here be stated that the anchor is admirably adapted for hard bottoms and strong currents, and that it possesses an important advantage over other types in the possibility of the different parts being easily separated for greater convenience of stowage.

When carried as spare gear, the main arms, centre arms and shank, lashed together, will occupy but a very small space on deck. The fact of its being made in sections also conduces to economy, as in the event of any part being accidentally broken or damaged, it can easily be replaced, as the manufacturer will keep duplicate parts in stock. When carried as the ordinary equipment of a vessel it can easily and snugly be stowed in the hawse pipe. The last, but certainly not the least important recommendation possessed by the anchor, is that it has no shearing or bursting strain.

The patentee is a practical man, who has worked during the greater part of his lifetime at the making of anchors, and for many years has had the chief responsibility for turning out work in a satisfactory manner at various forges and other establishments in the Midlands and in the North. Being a man who is observant as well as practical, he saw that there was still room for a new design of anchor, and after much thought and no inconsiderable amount of labour, he has produced one which, if nothing else, is certainly distinct from other types now in the market.

Mr. Thos. Beynon, of 9, Dean Street, Newcastle, has been appointed by the patentee as his principal agent, and it is not too much to say that, from a business point of view, he could not have chosen anyone more capable of giving effective help in securing the success of his enterprise.

Shipbuilding on the Tees.—Major Ropner, the retiring Mayor of Stockton, speaking at the annual meeting of the Town Council of that town on November 9th, said he was afraid that commercially they had the prospects of a very bad winter before them. To keep his shipbuilding yard going he had built a steamer to his own account, he had just laid down the keel of a second, and, rather than his yard should be closed and his men should suffer, he would build a third steamer to his own account. The cost of these steamers would be from £70,000 to £80,000. He hoped that the Council would do all in their power to keep down the expenditure in the present bad time, so as to keep down the rates.

H.M.S. "ROYAL OAK."

HAVING, on October 21st, successfully passed the ordeal of an official trial under natural draught, at which a mean collective H.P. of 9,221 was developed and a speed of 16·5 knots realized with ·27 in. of air pressure, the first-class battleship *Royal Oak* (built and engined by Messrs. Laird, of Birkenhead), completed her steam trials at Portsmouth, on Friday, October 24th, by the customary exacting run of four hours with forced draught. Though the propelling engines of the *Royal Oak* are substantially of the same type as those of the seven ships of the *Royal Sovereign* class, they differ in some respects, and more especially as regards the framing, from the machinery supplied by other makers. The cylinders are entirely supported upon wrought steel columns, strongly and substantially braced together, the guides being attached by cross beams to the main columns. This arrangement gives a light and novel appearance to the machinery, affords a practically uninterrupted view of all the moving parts, and brings home to the unprofessional mind a more distinct impression of the magnitude and power of the mechanical equipment of a battleship than the ordinary arrangement. During the trials this framing proved to be absolutely rigid and stiff, with a great saving of weight. The triple-expansion cylinders of each engine are 40 in., 59 in., and 88 in. in diameter, with a stroke of 51 in. The slide valves of the high and intermediate cylinders are of the piston type, while the low-pressure cylinders are fitted with flat double-ported valves, a special type of relief ring being attached at the back. Balance cylinders are also fitted to the high-pressure and intermediate valves, and assistant cylinders to the low, for the purpose of reducing the strains as far as possible. The main condensers have a collective cooling surface of 14,500 sq. ft., the circulating water being forced through the tubes by four centrifugal pumps, driven by independent engines. The crank shafts are in three separate pieces, the cranks themselves being set at an angle of 120° to one another. Steam is generated in eight single-ended cylindrical boilers, having each a working pressure of 155 lbs., and four furnaces. The total grate surface is 710 sq. ft., and the aggregate heating surface 20,174 sq. ft. For the purpose of shutting off each combustion chamber from the rest and of regulating the draught, separate dampers are fitted in the passage from each chamber through the smoke boxes, while gear is arranged to work the same from the stokehold floor.

For the purposes of the trial the *Royal Oak* was under the command of Commander the Hon. A. Bethell, and the engines were worked by Mr. R. Bevis, jun., on behalf of the contractors, who were represented by Messrs. William and John Laird, and among the officers who were officially present were Mr. Durston, Engineer-in-Chief of the Navy, and Mr. Butler from the Admiralty; Chief Inspector of Machinery Wootton and Fleet-Engineer Colquhoun, of the Dockyard Reserve; and Mr. Corner and Mr. Carat, of the Dockyard Steam Department. The trim of the ship was 24 ft. 4 in. forward and 25 ft. 5 in. aft, representing a mean draught of 2 ft. 7½ in. less than her designed mean load immersion. The battleship got under way from Spithead for a run up Channel, with a stiffish breeze on the beam, and by nine o'clock the first observations were taken, the eight forced draught fans making at the time about 300 revolutions a minute and producing a boiler pressure of 138 lbs. As a matter of fact, with the exception of the last half-hour, when the air pressure was high, the steam pressure was indifferent throughout the trial, owing, doubtless, to the circumstance that the stokers were not picked men, but ordinary stokers drawn from the harbour ships. The diagrams taken every half-hour worked out as follows:—

Boiler Pressure.	Air Pressure.	Revolutions.		Horse-Power.
Lb.	Inches.	Starboard.	Port.	
138	·99	100·8	100·7	10,754
149	·97	104·1	105·2	11,656
149	·92	104·2	103·1	11,627
149	·94	103·6	104·2	11,625
144	·91	102·3	102·4	11,282
142	·90	104·9	104·1	11,930
144	1·14	103·5	102·8	11,637
152	1·10	104.8	104·7	12,058

The resulting means of the four hours were:—Steam in boilers, 145·8 lb.; vacuum, 28·5 (starboard) and 28·4 (port); revolutions, 103·5 (starboard) and 28·4 (port); I.H.P.—starboard engine, high 1,480, intermediate 1,773, low 2,436; port engine, high 1,601, intermediate 1,802, low 2,479; total I.H.P. 5,689 (starboard) and 5,882 (port); collective H.P., 11,571, the excess over the contract, which was easily obtained, being 571. Although the air-pressure was comparatively high during the last hour, the average was ·98 of an inch, the maximum pressure permitted by Admiralty regulations being 2 in. The mean speed recorded by the patent log was 18·27, or nearly a knot more than the estimated speed in smooth water.

S.S. "PERTHSHIRE."

THIS vessel, which is the first of two specially built by Messrs. Hawthorn, Leslie & Co. for the Australian and New Zealand dead meat trade, for Messrs. Turnbull, Martin & Co., of London, has just recently started from the Tyne on her first voyage. Her insulated holds and 'tween decks have a total capacity equal to the carrying of nearly 2,500 tons of beef, mutton, fruit, and dairy produce, and they are refrigerated by machinery on the Linde system, supplied by the Linde British Refrigeration Co., Limited, 35, Queen Victoria Street, London, E.C. There are two machines, and one or both may be worked at one time. These machines are each self-contained on one bed plate, which forms the casing of the ammonia condenser. The ammonia compressors are compound, and so are the steam cylinders, which exhaust their steam into an independent surface condenser. The refrigerator consists of series of direct expansion coils in two sets, placed on the deck above the insulated holds. Air is caused to travel over the cold surfaces of these coils by means of fans, and the air thus cooled is then passed into the holds by means of air trunks in the usual way, the comparatively warm air being drawn back to the coils to be again cooled.

The refrigerating machinery was thoroughly tested in cooling the holds while the vessel was in the Tyne, and it worked without the slightest hitch. The official test took place on Nov. 12th, and in the course of a very few hours the mean temperature of the holds was reduced to about 4 degrees above zero Fahr., only one machine working. On the voyage round to Plymouth, a further test was made, when the holds were easily reduced to a mean of a little below zero. The machines are well designed, and very strongly constructed, and their working was much admired. Those conversant with the subject of refrigerating machinery were much interested in the rapid cooling of the holds to such a low temperature, and by the entire absence of brine or ammonia pipes in the holds. The circulated air was perfectly clear, and free from moisture, and there was no trace of snow in any part of the ducts. Quite a large number of Linde machines are now in use on board ship, both for the carriage of chilled and frozen meat, as well as for fruit and dairy produce, and these machines are applied both with the air circulation system as described above, and with the brine pipe system.

The s.s. *Buteshire*, which is the second of the vessels ordered by Messrs. Turnbull, Martin & Co., is now well on towards completion, and it is expected the trials of her machinery will take place in the course of a few weeks.

QUALIFICATIONS OF MARINE ENGINEERS.

A DEPUTATION from the Society of Marine Engineers waited upon Mr. Mundella, President of the Board of Trade, at the House of Commons on Wednesday, November 15th, in order to press upon him the necessity for various reforms in the law and the regulations as to marine engineers. Mr. Mundella was accompanied by Sir Courtenay Boyle, secretary to the Board of Trade. The deputation had with them Mr. Stewart Wallace, M.P.; Mr. Dalziel, M.P.; Captain Norton, M.P.; Mr. R. V. Barrow, M.P.; and Mr. Wm. Allan, M.P.

Mr. Stewart Wallace, M.P., briefly introduced the deputation.

Mr. Marshall, general secretary of the Society of Marine Engineers, London, said that there were five questions which they wished to lay before the Board of Trade. The first was the question of apprenticeship that had to be served before a man could aspire to a marine engineer's certificate. The society wished that all candidates for certificates

should be obliged to serve an apprenticeship of five years, instead of three, in the engine shop. Three years might have been sufficient in 1862, when the present regulations were framed, and when marine engineering was only in its infancy, but more was required now. The second point was that there ought to be an extra certificate granted—that was to say, there should be first, second, and third class certificates, instead of only first and second, as at present. As there were three watches in the engine-room at sea, the engines might be left for one watch out of three in charge of a man who held no certificate. If the proposal was given effect to, there would be a certificated engineer for each watch. In the third place, the society considered that some changes should be made in the Merchant Shipping Acts with reference to the status of the engineers. They wished that throughout the present Merchant Shipping Consolidation Bill engineers should be ranked as officers. That would only bring the statute law into harmony with the existing practice. At present the engineer had no official status on board ship. He was merely the man in charge of the machine. The fourth point was that marine engineers ought to be appointed members of Local Marine Boards, so that their profession might be directly represented on those bodies. The last matter was in reference to the engineer-manning of twin-screw steamers. A twin-screw vessel had two sets of engines, and was therefore equal to two steamers. She ought to have two complements of engineers—that was, four engineers on the present arrangements, or, if the contention for a third certificated engineer was given effect to, such a vessel should have six engineers.

The other speakers were Mr. Spencer (Shields), Mr. Boyd (London), Mr. Mills (Liverpool), and Mr. Allan, M.P.

Mr. Mundella, in reply, said: I am very glad to receive this deputation, and I shall be happy to receive the arguments in writing, as has been arranged, and to give them the fullest consideration. Of the five points you have put before me some can be dealt with by regulation—that is to say, the Board of Trade possesses statutory powers to enable them to deal with them. So far as they are concerned, I promise you they shall have speedy consideration. Indeed, the question of apprenticeships is now under consideration. We must all recognise the difference between the speed and complexity of the marine engine of to-day and the marine engine of 30 years ago. The advance has been so stupendous that the engines now are not like the same article at all. Even in your ordinary tramp steamers your engines are on a differing footing. Anything but triple-expansion engines is out of date, and, of course, you require more intelligent men and more intelligent handling. That we fully recognise. And so with the matter of extra certificates. That is a subject we are prepared to give our best attention to. We will probably gauge the feeling of those engaged in the profession, and of the best owners of steamships, as to the necessity for this change. With respect to the position and status of engineers, we will submit to the draughtsmen as to how far it is possible to extend the term "officer" throughout the Act to engineers. That is a matter of draughting and for the law. With respect to the appointment of engineers on Local Marine Boards, that is a matter I am quite entitled to deal with without any further assistance from Parliament. I promise you that when we make our next annual appointments if you can suggest to me any competent men who have served some years on board ship, who have practical knowledge of what is required, and who reside in any of the great boroughs, I should be very happy indeed to put a good practical man on the Marine Boards. I have done so with ordinary seamen; I have put seamen on almost every Marine Board in the kingdom. With respect to the increase of staff on twin-screw steamers, that would require legislation to make it obligatory. Whatever changes you want by legislation, your object is first to pass this Consolidation Bill. You cannot get changes in the law by that Bill; if you attempt it the Bill is dead. The Bill is to consolidate 40 or 50 or more Acts of Parliament that have been passed during the last 40 years or so, and that have become so complex and so difficult to construe that it is almost impossible to know what is the law, or to amend the law. It has long been desired that there should be a thorough consolidation of the existing Merchant Shipping Acts, and that consolidation is necessary for amendment. So we are pledged to the House of Commons not to consider any amendments of the existing Acts in this Bill. The Bill is to be made a plain, straightforward reading of the Acts as they now exist, in order that we may, as soon as it is passed, be in a position to make the amendments which are required. Amendments are desired from all quarters—engineers, pilots, shipowners, shipbuilders, seamen—everybody connected with the Mercantile Marine wants some amendment of the Merchant Shipping Acts. To have a clear merchant shipping code is one of the most desirable things I know within the range of our administration. I cannot promise you that I shall make amendments in the law during the present session, even though I approve them. If you want amendments in the law your plan is to help me with that Consolidation Bill. But in regard to all questions with which I am able to deal without introducing changes in the law, I am prepared to give them the most careful consideration, and they shall be considered promptly. In fact, some of your arguments are so forcible as almost to be irresistible, and the whole tendency of legislation and regulation has been to take care to increase the safety of our carrying trade and of our merchant shipping, and anything we can do to secure that end we shall be very happy to do. I agree with you that there ought to be qualified men and a sufficient number of them for the command of the mechanical department of every ship that goes to sea. Nothing could be more desirable, and considering we have had compulsory education in force for a good many years, and that there is no lack of engineers, there is no reason why every man who goes on board a merchant steamer as engineer should not have some knowledge and training of the practice of engineering, and sufficient knowledge of the science of it to enable him to properly discharge his duties.

The deputation thanked Mr. Mundella and withdrew.

TRIAL OF H.M.S. "BARFLEUR."

On November 9th the official full-power natural draught trial of the new first-class battleship *Barfleur*, built at Chatham Dock-yard and engined by the Greenock Foundry Co., took place in the North Sea with very successful results. The trial was to have been of eight hours' duration, but owing to darkness coming on it was limited to seven hours. The *Barfleur* is one of a pair of battleships of a new type, her sister ship being the *Centurion*, and has been fitted with triple-expansion engines estimated to indicate 9,000 H.P. under natural draught. The result of the trial were as follows:—Pressure of steam in boilers, 148·48 lbs.; vacuum in condensers—starboard, 27·3 in.; port, 27·7 in.; revolutions—starboard, 95·3 per minute; port, 95·9; I.H.P.—starboard, 4,962·18; port, 4,932·22; total, 9,894·40, or 894·40 in excess of the contract; speed by the patent log, 17·165 knots. The trial was conducted with open stokeholds, and the fan engines were not used once during the day. The boilers gave a good supply of steam, and the engines worked with perfect regularity throughout the trial, with an entire absence of hot bearings. The maximum H.P. developed during one hour was 10,615, while 10,070 H.P. was indicated for two consecutive hours. The ship was in charge of Captain Lord Charles Beresford, C.B., of the Medway Dockyard Reserve, the Admiralty being represented at the trial by Mr. R. J. Butler, R.N. The Greenock Foundry Co. was represented by Mr. John Scott, C.B., senior partner in the firm, and also by Messrs. C. C. Scott and Mr. Edward Mackay. The engines were in charge of Mr. W. Cairns, who superintended the work of fitting the machinery at Chatham Dockyard. The forced draught trial of the vessel on Nov. 4th, was highly satisfactory in every respect. The mean results were as follows:—Steam pressure, 142·4 lbs.; air pressure, 1·4 in.; vacuum, starboard, 27·7 in.; port, 27·4 in.; revolutions per minute, starboard, 104·8; port, 105·6; I.H.P., starboard, 6,580·4; port, 6,581·7; aggregate, 13,163·1. The contract was for 13,000 H.P. The speed by the patent log was 17·537 knots. The *Barfleur* anchored at the Nore at the conclusion of the trial and has received orders to return to Chatham to be completed for active service. Either the *Barfleur* or the *Centurion*—whichever is completed for sea first—will be despatched to the China Station to relieve the first-class cruiser *Imperieuse*, which will complete her second period of service as flagship early in the New Year.

The "Gothic."—This steamer, the latest addition to the White Star Line, will take in bunkers at Cardiff preparatory to making her first Atlantic trip. The *Gothic* is to be supplied with 3,500 tons of Cyfarthfa steam coal.

Dock Extension at Swansea.—The executive committee of the Swansea Harbour Trust at a meeting further considered the question of dock extension. It was decided that Mr. Abernethy should be employed to get out the plans only, the trust engineer supervising the works.

INSTITUTE OF MARINE ENGINEERS.

THE TESTING OF BOILERS.

Continued from page 340.

MR. J. MILNE said he thought the test employed at the present day of applying hydraulic pressure up to double the working pressure was about the best test they could possibly have. They could never find out the force or stress that was brought to bear on the boilers by the contraction or expansion of the metals; no tests in the world would show that. They could never get at the strains on the material of the boilers under the various conditions of work at sea, and he thought the Board of Trade had acted very wisely in fixing the factor of safety at five, because they were providing for something about which they could never be certain. They might know the thickness of the plates, but when they were working the fires at sea and opening and shutting the doors they could not know the pressure that was brought on the plates. All those who had sea experience had often found the rivets beginning to leak when cleaning fires. What made them leak? The contraction of the metal made them leak, and the expansion of the metal made them tight again. He thought, therefore, that the hydraulic pressure test up to double the working pressure was about the safest test they could possibly have prescribed, and he saw no reason why they should not be allowed to come up to that pressure for testing purposes with cold water. It was a safe pressure to bring to bear on a boiler, and if a boiler gave way at that pressure it would hurt no one. A boiler that would not stand a test of twice the working pressure ought not to be allowed to go to sea. He objected to caulking seams with water in a boiler, because he thought it would be impossible to make them tight. It would be impossible to bring the plates together because there was a body between the two plates— A Member: "Why not? It is a fluid body."] True, it was a fluid body, but they could not compress it. With regard to old boilers, he once had an order from a surveyor to test an old boiler up to twice the working pressure. He first tried it with a hammer, and came to the conclusion that it was very thin. He then bored holes, but holes never gave the average thickness of a plate. He afterwards applied double the working pressure, and the whole back came out, and an examination of the plate showed that its condition was discovered none too soon for safety. He thought that at all times the test pressure for both old and new boilers should be carried up to twice the working pressure. His idea was that the testing of boilers under actual working conditions would never be carried out, because it was impossible unless they lit the fires and let steam go on until it burst the boiler, but there were not many who would care about trying that experiment in order to find out the truth of the matter.

Mr. F. W. Shorey said that with regard to new boilers the last speaker had advocated putting on hydraulic pressure up to double the working pressure. He (Mr. Shorey) entirely differed from that view, and thought that many new boilers had been overstrained by having been tested in this way. With the high pressures that were now employed he considered it almost absurd to subject new boilers to a test of double the working pressure. Most of the boilers of the present day were built under survey. The plates were tested to begin with, and they knew very well both the quality of the plates and the class of the rivets. Then the next thing was to secure good workmanship. If the men were looked after, and the boiler was put together in a proper and workmanlike manner, they should then subject the finished boiler to hydraulic pressure, not to see what pressure it would stand, but simply to ascertain if the workmanship was all right—to ascertain if there were any leaky seams, tubes or rivets. After that he would subject the boiler to hydraulic pressure up to about a quarter above the working pressure, and then he would submit it to a steam pressure, up to a quarter above the working pressure, and raise the steam very slowly. Supposing, for instance, they were going to work a boiler at 150 lbs., let them first apply hydraulic pressure up to 200 lbs., and then get up steam very gradually until they obtained 200 lbs. pressure. By this means they would not be straining the boiler unduly, and the boiler would be brought into work in a very much better condition than was often the case under the present system. They saw many boilers give way under steam after being subjected to hydraulic pressure up to double the working pressure, and he thought this often occurred because the boilers had been overstrained in the first instance. He had caulked boilers when under pressure, but as a matter of experience he had found that he could caulk a boiler much better empty than when it was full of water.

Mr. Anderson said he had had to do with a number of boilers that had been tested up to double the working pressure, and he never found that any harm was done. There was no better test than the water test, and if there was a faulty seam it would be sure to find it out.

Mr. Greer said he did not believe they could caulk a boiler well with water in it, but he knew that when boilers were under steam at sea it was possible to touch up weak spots here and there and stop the leaks. If a boiler would not stand a test of double the working pressure it ought not to be used.

The Honorary Secretary then read a communication that had been received from Mr. Thomas Don, of Newhaven, who wrote, "The hydraulic test of a boiler, being a trial as to tightness as well as strength, gives some measure of assurance as to its condition. A considerable leak or a sudden enlargement of the water space, say from bulging, would show on a diagram, but there are defects of wear and tear discoverable by a careful internal examination calling for immediate steps being taken, which would not be revealed in a diagram, as the boilers may be just strong enough to stand the pumping up without giving out. I refer to some eaten-away places, pitting, or other weak spots, which might be covered with the thumb, and the wasting away on the front and back end plates of circular boilers at the bottoms, in the flange fillet, in a manner that cannot be called uniform. The causes which lead to these defects being still at work and developing rapidly, compel that these places, which might be covered by little more than a shilling, should be patched. No doubt the unequal expansion largely accounts for the distress at the bottoms, added to the want of circulation, probably at its worst each time of raising steam from cold water. The lifetime of a circular marine boiler is to some extent affected by the conditions and number of times the fires are lit up, as well as by the number of years in use."

Mr. W. H. Northcott, whose communication was also read by the honorary secretary, wrote as follows:—"The principal point raised by Mr. Livesey appears to refer to the 'test pressure' Should that be twice the working pressure or something less? Mr. Livesey expressed the opinion that double the working pressure is not an excessive test, and further, that under present circumstances this test could not, in the interests of safety, be reduced for new boilers. With this opinion I entirely concur, in so far as relates to mercantile boilers. But I think absolute tightness at that pressure should not be insisted upon. The object of water pressure testing is to find out defective materials or workmanship, not to demonstrate the severity of the fullering and caulking. If the boiler is tight at 50 lbs. per inch above the working pressure, after the maximum pressure has been applied, a few weeps at the maximum pressure should be left alone. Where, as with Admiralty boilers, only first-class boiler-making firms are allowed to make the boilers, and only first-class firms are allowed to supply the materials—where also the materials are carefully tested and the work rigidly inspected during progress, a test pressure of 90 lbs. in excess of the present working pressure of 160 lbs. per inch is no doubt ample. Whether the present Admiralty rule will have as much effect upon the general engineering practice of the country as the President anticipates is another matter. There are obvious reasons why the Board of Trade should be very much less exclusive than the Admiralty in regard to the firms who are allowed to make boilers. Apart from this, however, were the cylindrical marine boiler and a pressure of, say, 160 lbs. per inch to become perpetuated, the Admiralty rule might probably be generally adopted. But even now the Admiralty are trying various types of tubulous boilers, with which the objection to high pressure testing does not obtain in any way. Had the tubulous boiler been introduced before the Admiralty had decided on a test pressure of 90 lbs. in excess of the working pressure, the Admiralty rule would have had no *raison d'être*, and we should never have heard of it probably. I suspect the rule will disappear with the cylindrical boiler. That may not be yet, but although the tubulous boiler is far from being perfect, some varieties have been tested at sea quite long enough to show that they can be made to answer. With a tubulous boiler a pressure of 500 lbs. per inch is quite practicable, and for such a boiler and such a pressure I would suggest as a suitable test that the boiler should stand a water pressure of 750 lbs. per inch without showing over-straining, and that all joints, &c., should be quite tight at 600 lbs. per square inch. No system of water-testing can reproduce or represent the stresses set up by unequal temperatures. The use of hot water won't do this, and it does introduce danger and inconvenience. If the

water is above 212 deg. F. hot water testing is nearly as dangerous as steam testing, but apart from this it is impossible to properly examine a hot boiler. Some engineers object to a squirt of cold water in the eye or down the neck, and the objection might be stronger if the water were boiling. I do not see that it is possible to reproduce the stresses set up by opening a fire-door or blowing air through an uncovered grate except by reproducing the causes, and it is useless setting up these stresses unless the conditions are such as to allow the effects of them to be inspected and measured. With regard to Mr. Livesey's remarks it is unfortunately quite possible for a furnace to stand a water pressure of 800 lbs. and yet to come down at 150 lbs., but the possibility does not throw any doubt upon the 800 lbs. test. When the tube he refers to stood 800 lbs. it was cold, when it came down it was probably red hot. What is wanted here is not a different system of testing, but a different system of circulating the water when the boiler is at work. As Mr. Livesey, states it is very desirable to get rid of all the air, so as to have solid water only when testing. Some engineers say they prefer to have a little air, as it forms a cushion. I prefer solid water. Caulking under pressure is, no doubt, a common practice, but, in my opinion, a very unwise one. It says a great deal for the sufficiency of the margin of safety that boilers so treated do not go off under the process.

Mr. A. W. Robertson said that, in his opinion, the essence of the paper under discussion was to be found in those paragraphs which asked for more information about boiler testing, and gave the unsatisfactory results which attended the working of steel at a blue or black heat. In another part of the paper the author said:—"Testing by water-pressure to double the working load to the satisfaction and approval of the surveyor responsible for the test is the usual standard, but many with an inquisitive nature endeavoured to understand the 'why and wherefore,' and when so much diversity of opinion exists as to what is a reliable boiler test a candid expression of opinion may do much towards settling a few knotty points." He (Mr. Robertson) quite agreed with the author of these remarks, which he understood to ask "the why and the wherefore" that the water test of double the working pressure was applied? As was observed by the Chairman on the last occasion, the testing of boilers was more a question of discovering bad workmanship than of ascertaining the strength of the material employed. But coupling the inquiry in the paragraph he had quoted with that portion of the paper which related to the working of steel, he thought they might reasonably reply that "the why and the wherefore" consisted in a great measure in the necessity for ascertaining not only the workmanship but whether the steel had been manipulated in the manner set forth by Mr. Livesey; and, if not, he (Mr. Robertson) would ask why was the double-the-working-load test to be applied? If the confidence of our surveyors in the material employed was so great, after the careful scrutiny and examination which it underwent, why, he asked, should they insist on the shells and internal parts of the boiler being subjected to such a tremendous test as double the 'working pressure. When they looked back a few years and found boilers working with a pressure of 20 lbs., surveyors were satisfied with a test of an additional 20 lbs. Now that we had boilers working at 160 lbs., they were not satisfied with another 20, or 40, or even 60 lbs., but wanted another 160 lbs. Carrying that argument to an extreme, for the purpose of illustrating his meaning, supposing they had got a boiler of the marine type constructed for a working pressure of 1,000 lbs., would any gentleman present say that it was in accordance with reason or common sense that material should be introduced into that boiler to support a pressure under test of 2,000 lbs.?

The Chairman: I am prepared to say that I have tested up to 2,000 lbs. for a working pressure of 1,000 lbs.

Mr. Robertson: Still you will admit that you were not convinced that it was necessary or even wise to have the material tested to stand a pressure of 2,000 lbs.

The Chairman: The maker was willing to put it up to 3,000 lbs.

Mr. Robertson: Well, perhaps I am wrong in making these remarks, but that is my opinion. The author of the paper said he approved of testing up to double the working pressure because of the "sunken rocks" which still existed, especially in boiler shops where the punch and the drift were very accommodating tools. After all the experience we had now acquired of boiler-making, and in view of the confidence we had in the steel put into boilers, he contended that in the construction of boilers intended to carry anything like 160 lbs. pressure neither punch nor drift should be used. He contended, further, that the surveyor, even at the cost of a larger fee, if he had a doubt about the honesty of the manufacturer, should be in close attendance and see that the punch and the drift were not employed. In his opinion it was unnecessary, with their present knowledge and experience of boilers and their construction, to apply a test of double the working pressure to a boiler when the working pressure was over 100 lbs. He would draw the line at 100 lbs. and say that where the working pressure was over that figure there should be a percentage added for the purposes of the test. With regard to the arrangement of furnace flues, he asked if it had not struck several of the gentlemen present that the very element which was introduced as a factor of safety often proved a factor of destruction? The more metal they had in a furnace flue, if rigidly bound, as was usually the case, the greater the strain that was brought to bear by the variation of the temperatures. He thought they would have a far safer furnace if in the construction of the boiler the furnace was made so that it would be free to yield or give with the expansion and contraction of the metal. They must also admit that the human factor in relation to the working of boilers was susceptible of very great variation under various conditions; and although in the majority of instances the greatest care was exercised, they could all recall cases where the want of the necessary judgment had brought about disaster. Were the boilers so constructed that they would become, if he might use the expression, more automatic in their action, he thought they would have fewer disasters and a greater amount of confidence in working.

The Chairman said he was inclined to think that the author's wish for more information on the subject of boiler-testing would be best met by considering what a test was applied for. In his (the Chairman's) opinion a test of a boiler after construction should be made so as to ascertain that the several parts of the boiler had been properly put together in accordance with the design of the constructor of the machinery. The design should have been made to accord with a given load or stress on the material of which the boiler was to be constructed, so that the working pressure of the boiler should stress the material when it was constructed in a certain proportion or ratio to the ultimate strength of the material, as proved by the result of testing the several samples of the plates &c., of which the boiler had been built up. The question immediately arose what should be the proportion or ratio between the working pressure stress per square inch and the ultimate strength of the material per square inch? To get an answer to this question was, he thought, more immediately the aim of the author of the paper. The Chairman continued: To any person wishing to qualify himself for judging and fixing the working pressure of new or old boilers that come under his notice for the first time, and of the construction of which he cannot get any reliable particulars, I would give the advice that he strenuously study the Instructions to Surveyors of Steamships carrying Passengers, issued by the Board of Trade (1893). Or, if he wishes to go still further, Mr. Traill's book on the construction of boilers will be of much assistance to him. Having mastered the details of boiler construction, he must determine for himself as to the factor of safety he will adopt for his own use, and in this no doubt there is a large margin to come and go upon and to choose from. I have heard it argued that a factor of safety of three is sufficient, which means that the boiler shall be worked at one-third of its ultimate strength, as found by calculation, using the ultimate strength of the materials as obtained by the test of the samples in the testing machine—a condition of affairs which I think would soon bring a fleet of steamships worked on this principle to grief in loss of life and property. Again, it has been argued that the factor of safety should be 8. Certainly this is the other extreme, and in face of the Board of Trade having adopted a factor of safety of 5, could not now be maintained for a moment. You will perceive from this that there is a large margin between the two cases, and the question arises what should a person do who is far away from all counsel and advice and who has to act on his own responsibility? On no account should he accept the test pressure as the strength of a boiler, or he may find himself landed in working a boiler with a factor of safety of a little over 2, or at nearly half of its ultimate strength. The only safe course is for him to take (in the absence of sample tests) the average value of good iron at 21 tons per square inch, and of steel at 27 tons per square inch, using a factor of safety of 5, or one-fifth of the above values, as the stress per square inch to which he will subject the material of the boiler when it is under

the full working pressure. The calculations should be made from actual measurements taken from the boiler itself. After a long experience I can recommend no better way of ascertaining the working pressure at which a boiler may with safety be worked. In cases where the riveted seams of a boiler cannot be measured for calculation as to strength of joint, it will be advisable to assume a strength of 56 per cent. of plate for a single riveted joint, and 70 per cent. for a double riveted joint. After thus obtaining the working pressure of a boiler, the water test should in all cases be applied, as in that test only can all parts be inspected when under test. There is nothing in this test to prevent the water in the boiler being heated so as to assimilate more nearly to the normal condition of the boiler when in actual service. From a long experience I have not seen any reason to change my opinion that in the case of a new boiler it should be tested to twice its working pressure and gauged during test for any deformation. For old boilers the test should in my opinion be at least one and a-half times the working pressure. But on no account should the test pressure be applied without the tester being fully aware of the structural strength of the boiler as found by calculation.

EDMUNDS'S INSTANTANEOUS LIQUID FREEZER.

A NEW freezing machine, in a compact form, has been brought out by Mr. K. G. Edmunds. It is claimed that this machine will freeze almost any liquids (except oils) in less than a minute, and has the following characteristics :—Simple in construction and working, easy of adjustment, can be operated by any ordinary person, is very portable, is practically unbreakable, and will last for years without even need for repairs.

The general construction of the machine is as follows :—Within a suitable wooden case, a half cylindrical tank is arranged, into which tank the liquid to be frozen is placed. Within this tank is placed a cylinder, which is adapted to revolve upon trunnions, the cylinder being of such a size as to nearly fit the tank.

The cylinder is revolved by suitable gearing operated by a crank handle. One of the trunnions of the cylinder is made hollow, and is provided with a screw cap over an orifice. When the cap is removed, this orifice affords a means of communication with the interior of the cylinder, and it is through this aperture that a freezing mixture is introduced into the cylinder, upon which the cap is screwed on to the trunnion in order to hermetically close the chamber. When now the cylinder is revolved in the tank containing the mixture to be frozen, the freezing mixture within the cylinders absorbs the heat from the surface of the cylinder, which in turn absorbs the heat from the liquid, and by the continual change of surface of the cylinder thus cooled, the liquid in the tank is thus cooled in temperature to such an extent that it becomes frozen upon the exterior surface of the revolving cylinder, which carries the frozen liquid over to the front of the machine, where a shoot is situated having a scraper edge, which rests against the exterior surface of the cylinder and scrapes off the frozen liquid that has accumulated thereon, the frozen product being precipitated down the shoot into any suitable receptacle. Anyone wishing to obtain further particulars of this machine can do so by applying to Mr. K. G. Edmunds, Brookes' Hotel, 33 & 34, Surrey Street, Strand, London.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our own Correspondent.)

New Naval Programme.

THE movement for an increase to the Navy which is referred to elsewhere, has received a great impetus by the publication of a scheme drawn up by Lord Charles Beresford in March last and now published by Mr. J. Jackson, of the London Chamber of Commerce. Lord Charles Beresford says that this country can only build 74 large men-of-war at one time. This fact was ascertained by personal inspection and observation at all the naval and private yards capable of building her Majesty's vessels. Moreover, the resources of the country cannot provide the necessary material, armour, stores, and ammunition for more than about 70 vessels in the time they would take to build. He makes the basis of his proposals that the British fleet should be one-third stronger than those of France and Russia combined. These Powers own 45 battleships, therefore this country should have 60, but she has only 42, therefore 18 additional ships are required. In the same manner he compares the cruisers, and his programme complete is as follows :—

6 *Royal Sovereigns*	£5,376,000
12 *Barfleurs*	7,550,000
10 *Blakes*	4,320,000
10 New class ironclads	2,600,000
50 *Havocks*	1,800,000
30 Torpedo boats	450,000
Gibraltar moles	634,000
Reserve ammunition and stores	500,000
Total	£23,240,000

But since his proposal was made on March 30th, 1893, the following ships have been projected :—Battleships, *Magnificent*, *Majestic* and *Renown* (£2,620,000) ; cruisers, *Powerful*, *Terrible* (about £800,000 each), *Talbot*, *Eclipse*, and *Minerva* (about £250,000 each) ; ten torpedo boats (£150,000)—total, £5,170,000, so their cost would be deducted from the original proposal, leaving £18,070,000.

New Ships to be laid down.

The drawings of the battleship *Majestic* have been received at Portsmouth Yard, but the ship is not yet begun. The second-class cruiser *Eclipse* was laid down in November, and work on her has commenced. She is to be 350 ft. in length, with 53 ft. beam, and a displacement of 5,600 tons. Good progress having been made at Chatham with the alterations to No. 7 slip, the *Magnificent* battleship was commenced there, a portion of the slipway being cut away for the purpose, but orders have now been received to stop the work temporary. It was from this slip that the *Barfleur* was launched in 1892. The work was not going ahead very fast, for lack of the steel plates and bars from the contractors. However, a large quantity of material, to be used in her construction, has been prepared, and 400 hands are to be employed on her up to March next. The *Minerva*, second-class cruiser, will be commenced as soon as preparations can be made now that the *Dryad* has been floated out. This vessel is a sister ship of the *Eclipse*, mentioned above. The *Talbot*, another ship of this class, is hardly likely to be started at Devonport this year, as the *Harrier* gunboat, now occupying the slip on which she is to be built, will not be ready for launching much before March, 1894. At the same time, good progress has been made with her machinery at Keyham. Four of her eight boilers are well advanced, and the furnaces, made by contract, are all in hand.

Portsmouth Dockyard.

The *Royal Oak*, battleship, has been delivered at this yard from Birkenhead, and is being prepared for her trials. She made a satisfactory run round to Portsmouth, averaging 15 knots. The *Revenge*, battleship, built and engined by the Palmer Co., has made creditable contract trials. The forced draught trial was made with only 46 in. of air pressure, and the speed recorded was 17·3 knots with natural draught, and 17.5 knots with the above amount of forced draught, which seems a very trifling difference, but as the ship was light too much importance must not be attached to these speed results. The H.P. was attained without much difficulty. The *Centurion*, battleship, is well advanced towards completion and is to relieve the

present flagship in China. The *Resolution*, battleship, has made her gun trials, but she is not so forward as the *Revenge*, which vessel will probably be completed first. The *Centurion* should be completed by the end of December. The *Ramillies*, battle ship, commissioned here has sailed for the Mediterranean, for which station the *Anson* and *Vulcan* have also left. The *Colossus* has returned home from the Mediterranean, and having paid off has been re-commissioned to relieve the *Neptune* as coast-guard ship at Holyhead. The *Mistletoe*, Channel Island steamer, has come in for refit, and the *Research*, surveying vessel, to lay up during the winter months. Messrs. J. & G. Thomson have secured the contract for supplying new triple-expansion engines for the *Sultan*, 6,500 H.P. with natural draught and 8,000 with forced draught.

A New Engine-room Telegraph

The great difficulty experienced on board ship in communicating through voice pipes from the bridge to the engine-room the number of revolutions at which the engines are working is likely, says the *Western Morning News*, to be overcome by the adoption of what is described as a simple, inexpensive, and efficient means of communication. The new arrangement, which is the invention of Mr. G. A. Haggarty, engineer, R.N., has been submitted to the Admiralty, and their lordships have directed the naval and dockyard officials at the home ports to give their opinions as to the desirability of introducing it into the service. It is called the "pneumatic revolution telegraph," and consists of four ordinary vacuum gauges marked for revolutions, two of these gauges being intended for use on the bridge, and the other two for the engine-room. By this telegraph the officer of the watch can not only communicate with the engine-room, but one of the gauges—termed the reply gauge—will at once show him if his order has been clearly understood. One great advantage of the telegraph is that a difference of one revolution is easily discernible. During the recent manœuvres Mr. Haggarty, who was serving in the *Apollo*, by permission of Captain G. A. Primrose, put his idea to a practical test, and with extemporised appliances the arrangement proved successful. Both Captain Primrose and Mr. John S. Watch, staff-engineer of the *Apollo*, were so favourably impressed with the experiment that they communicated the result to the Admiralty, and their report has undoubtedly been the means of their lordships recognising the invention.

Torpedo Boat Destroyers.

The success of the torpedo boat destroyer *Havock*, built and engined by Messrs. Yarrow, has decided the Admiralty to commence the construction of several more of these vessels this year. Six were originally ordered, two each from the firms of Messrs. Yarrow, Thornycroft, and Laird. The two first named firms have now received orders for three more vessels each, while nine others have been ordered severally in twos or threes from Messrs. Palmer, J. & G. Thomson, and Hanna & Wilson, of Glasgow. Mr. White, of Cowes, will also undertake the construction of two similar vessels, so that 23 destroyers are now in course of construction.

Chatham Dockyard.

The *Barfleur*, battleship, has made satisfactory trials, and will now be got ready for commissioning, the date fixed being some time in April next. The *Howe*, battleship, has left the yard for the Mediterranean. The *Barracouta* has also commissioned here, and left for her station. The *Basilisk*, a sister vessel, which she will relieve, has paid off. The refit of the *Agincourt* and *Monarch* is to be hastened and more hands will be put upon these vessels. Messrs. Maudslay are to supply new machinery for the last named ship. The *Grafton*, recently delivered here, is also being hurried forward in readiness for the pennant. The new cruiser *Forte* was completely sheathed with teak in eight weeks, a very creditable record. The repairs to the *Landrail* are in hand, and all the torpedo gunboats in the reserve here are to be prepared for further work, the defects occasioned by the manœuvres being made good with all despatch. The topmasts and yards of the *Agincourt* have been replaced, but the yards and sails of the *Monarch* are to be abolished, military masts and tops, as supplied to the *Alexandra*, being fitted instead. The trials of the *Martin* induced draught apparatus in the *Gossamer* have not hitherto proved a success, but after some more alterations in the machinery the experiments will be renewed. The authorities sanctioned the fitting of Messrs. Eversheads & Richards' engine-room telegraph on board the *Howe*. The *Skipjack* is to relieve the *Sandfly* in the Mediterranean.

New Ships Launched.

The *Hermione*, a sister ship of the *Bonaventure* was launched at Devonport on November 7th, the ceremony being performed by Lady Lyons, wife of Admiral Sir Algernon Lyons, the Commander-in-Chief at Plymouth. This vessel was laid down in December, 1891, on No. 2 slip, which is situated on the new ground near Mutton Cove, she has therefore been nearly two years in course of construction, a long time for such a vessel. A sister ship, the *Forte*, was launched at Pembroke dockyard on November 9th, and in her case the christening ceremony was performed by Mrs. FitzGerald, wife of Captain C. P. FitzGerald, the Superintendent of the yard. The *Flora* was laid down in March, 1892, and is being engined by the Naval Construction and Armaments Co., of Barrow. The *Dryad*, torpedo gunboat, was floated out at Chatham on November 25th, being christened by the daughter of Admiral Sir Algernon Heneage, the Commander-in-Chief at the Nore, she was commenced only last April, and is to be completed by March next. The *Forte*, cruiser, is to be launched at this yard on December 9th, when Lady Charles Beresford will act as sponsor for the new vessel. The *Minerva* will be laid down in the dock vacated by the *Dryad*.

Devonport Dockyard.

The *Warspite* and *Forth* are at last off my list, and will be before the first week in December is out, the one on her way to Queenstown, and the other to the Fleet Reserve. The *Phaeton* is still in Keyham basin, but her refit will not be taken in hand before next year, when upwards of £13,000 is to be expended for the purpose. The *Conquest* and *Carysfort*, cruisers, are to be brought forward for service in the Training Squadron, and the latter will require a good deal done to her to make her efficient. The *Bonaventure* is as good as completed, but there seems to be doubt now whether she will go to the Australian station after all; some bollards for her are to be made here instead of by contract as originally ordered. The *Halcyon*, *Hussar* and *Harrier* are in hand and progressing, the former will be ready for launching next February; extra shipwrights have been put on in these vessels. The steam trials of the *Astræa* are looked forward to with some special interest, as the machinery was manufactured in the factory here, and is the largest set yet built in the west country. The machinery for the *Hermione* arrived from the contractors, Messrs. J. G. Thomson, and no time will be lost in placing it in position.

Sheerness Dockyard.

Preparations are being made here for commencing the construction of the gun-vessels *Torch* and *Alert*, which will be built side by side in No. 2 dock. The materials for their construction are already in hand. They will be 180 ft. in length, 32 ft. 6 in. in beam, and will draw 11 ft. 6 in. of water. A good deal of work is still going on in the *Charybdis*, her topsides being built now as there was not room in the shed before she was launched. The *Forte* is out of hand and ready to be used as a coal depôt in the stream. The *Rambler's* repairs are finished, and she is out of dock in the basin, where she will be prepared for the pennant. The forced draught trials of the *Hebe* were most successful and most creditable to this yard, where her engines were made. Over 4,000 H.P. was attained, but the mean figures were:—Pressure of steam, 142 lbs.; air pressure, 3·6 in.; I.H.P., 3,893·4. This is the highest power attained with any of this class of vessel except the *Speedy* and the *Renard*. The engines of the *Torch* and *Alert* will now be made in the yard.

Ship Canal.—It is now settled that, in the absence of an unforeseen event, the first steamer will go from Liverpool to Manchester, along the whole course of the Ship Canal, on Thursday, December 7th. The steamer will carry the directors, who will inspect the waterway through its entire length.

First-class Protected Cruiser.—The *St. George*, the last of the first-class protected cruisers laid down in accordance with the Naval Defence Act, will be delivered at Portsmouth on December 12th for her steam trials by Earle's Shipbuilding and Engineering Co., Hull.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from October 26th, 1893, to November 25th, 1893 :—

A'Court, J., staff engineer, has been advanced to the rank of fleet engineer in Her Majesty's fleet.

Allen, W. T., staff engineer to the *Neptune*, undated.

Alton, George B., staff engineer to the *Devastation*, to date December 5th.

Anstey, H. C. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Baker, Alexander, engineer to the *Vivid*, additional, to date October 26th.

Baldwin, G. W. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Barnett, H. S. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty fleet.

Barter F. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Batchelor, Harry R., engineer to the *Inflexible*, undated.

Bedbrook, James A., inspector of machinery, to the *Wildfire*, additional, to date November 2nd.

Bell, Lawrence, engineer to the *Bramble*, to date October 26th.

Bills, W. H. T., fleet engineer to the *Resolution*, to date December 5th.

Bills, W. W. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Block, R. J. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Bowing, J. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Bushby, J. F. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Cleave, T. W. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Cockey, G. H. (prabationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Cox, F. S. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Crabtree E. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Denison, Edward L. H., engineer to the *Renard*, undated.

Denny, John T. H., fleet engineer to the *Colossus*, undated.

Dewhurst C. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Dohkin, C. L. F. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Drake, Sidney J., engineer to the *Sparrow*, to date October 26th.

Durston, A. J., inspector of machinery, has been promoted to the rank of chief inspector of machinery in Her Majesty's fleet.

Durston, Albert John, chief inspector of machinery to the *President*, additional, for the Admiralty, as engineer-in-chief, to date November 15th.

Fawckner, S. M. O. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Ferguson, S. P. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Figgins, J. W. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Finch, James J., inspector of machinery to the *Hibernia*, additional, to date November 2nd.

Flood, Frederick J., engineer to the *Onyx*, additional, to date November 16th.

Galpin, Joseph P., engineer to the *Rambler*, to date October 28th.

Garwood, H. S. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Gaudin, Edouard, engineer to the *Boxer*, to date November 16th.

Gedye, H. A., acting engineer, has been confirmed as an engineer in Her Majesty's fleet.

Gregg, C. J. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Green, A. G. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Hardcastle, Corin V., engineer to the *Resolution*, to date December 5th.

Harris, Herbert W., engineer to the *Inflexible*, undated.

Henwood, John W., staff engineer to the *Serapis*, to date November 8th.

Hird, James, assistant engineer to the *Resolution*, to date December 5th.

Howell, L. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Hughes, T. C. E., engineer, has been promoted to the rank of chief engineer in Her Majesty's fleet.

Hyde, Thomas H., staff engineer to the *Audacious*, to date November 7th.

James, W. H., engineer to the *Colossus*, undated.

Johnson, W. C. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Kestell, E. R. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Kimber, John L. (probationary), assistant engineor to the *Resolution*, to date December 5th.

Kingsnorth, Arthur F., engineer to the *Niger*, undated.

Langhorn, Henry, fleet engineer to the *Inflexible*, undated.

Lowe, J. Y., engineer, to be senior engineer.

Mabb, William J., chief engineer to the *Niger*, undated.

Markham, R. G. L. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Meaden, N., staff engineer, has been advanced to the rank of fleet engineer in Her Majesty's fleet.

Morris, Thomas, staff engineer to the *Swiftsure*, to date December 5th.

Morison, R. B. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Murray, W. H. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Olive, William, fleet engineer to the *Nelson*, undated.

Olver, A. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Osbourne, Charles E. H., engineer to the *Resolution*, to date December 5th.

Pallatt, W. H., engineer to the *Speedy*, to date November 16th.

Parrott, J. W. A., engineer to the *Hibernia*, additional, to date November 13th.

Pearse, William J., engineer to the *Devastation*, to date December 5th.

Pibworth, W. H., staff engineer to the *Iron Duke*, to date November 7th.

Pratt, W. H. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Rampling, Henry J., chief engineer to the *Basilisk*, to date November 10th.

Rawling, S., engineer, has been promoted to the rank of chief engineer in Her Majesty's fleet.

Reynolds, James A., engineer to the *Narcissus*, to date October 26th.

Rigler, George, fleet engineer to the *Victory*, additional, undated.

Rosevere, E. J. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Rundle, M. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Saunders, A. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Shattock, T. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Shelton, R. W. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Spence, R. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Spencer. A. P. S. (probationary), assistant engineer
confirmed as assistant engineer in Her Majesty'

Sutton, A. W. (probationary), assistant engineer
firmed as assistant engineer in Her Majesty

Sutton, F. J. (probationary), assistant engir
firmed as assistant engineer in Her M

Sydenham, F. W. (probationary), assis
confirmed as assistant engineer in I

Tench, R. J., staff engineer, has been
fleet engineer in Her Majesty's fle

Turner, Arthur W., engineer to the *S*

Underhill, A. M. (probationary), ass
confirmed as assistant engineer in

Wall, Henry M. (probationary), assistant engineer to the *Resolution*, to date December 5th.

Walmsley, Charles A., fleet engineer to the *Victory*, additional, undated.

Watson, L. J. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Watson, Alfred D., chief engineer to the *Vivid*, additional, to date November 3rd.

Weeks, G. J., fleet engineer, has been placed on the retired list of his rank.

White, A. F. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

Wingfield, Henry E., staff engineer to the *Assistance*, to date November 8th.

Wormald, G. (probationary), assistant engineer, has been confirmed as assistant engineer in Her Majesty's fleet.

HOAR & BROWN'S HARDWOOD MARKET REPORT, NOVEMBER 22nd, 1893.

THE stock of timber is diminishing, owing to the absence of any fresh arrivals. Sales of good wood in small quantities are being made at fair prices, but competitive quotations for supplies of any extent are still very low. The absence of demand alone is the cause of the depression in values, and should enquiries become at all numerous, prices may be expected to advance.

Planks are arriving in quantities far above any possible requirements, and the stock in London at present is more than double what it ought to be, consequently low quotations are the rule.

MAHOGANY.—Large-sized Tobasco and Honduras logs have not been offered very freely, but a preponderance of medium to small wood has been forced upon the market, causing values to decrease considerably for the time. A further quantity of large wood is wanted.

CUBA is still, to a great extent, held by the importers, and a damaging feature in this class also, is the great quantity of small logs. Importers' ideas are still far beyond the market values.

CEDAR.—Arrivals have been more frequent lately, and prices have receded somewhat. Two parcels of Cuba are now upon the market.

KAWRIE PINE.—In consequence of the advance in Quebec Pine, especially first quality broad planks, Kawrie has, in sympathy, been going off well, and fetching enhanced figures for anything wide. Considering the Quebec prices are not likely to fall soon, it is expected that Kawrie will maintain its value for at least six months.

SEQUOIA.—Our remarks respecting Kawrie pine apply to this wood also.

PADOUK is going off fairly well, especially upon the Continent, and present quotations are likely to be maintained. Stocks cannot be considered excessive, but the demand is always slight one, and does not encourage importations.

Business as a whole may be reported as improving.

Trial Trip of the s.s. "Castanos."—On Friday, November 24th, the s.s. *Castanos*, a fine large steamer built by Messrs. Wm. Gray & Co., Limited, to the order of Messrs. Morel Bros. & Co., of Cardiff, had her trial trip in the bay off Hartlepool. The vessel is of similar model and capacity to the *Penarth*, which they recently delivered to the same owners, and which is giving great satisfaction. She takes Lloyd's highest class, and is of the following dimensions:—Length, over all, 335 ft.; breadth, 42 ft. 6 in.; depth, 26 ft. 10 in. Her equipment is that of a first-class cargo boat. The engines have been built by the Central Marine Engine Works, and are 24 in., 38 in., and 64 in. in diameter, with a piston stroke of 42 in. Steam is supplied by two large steel boilers. The trial was of a very satisfactory character, the engines running with perfect freedom and smoothness, no heating being apparent at any of the bearings. Mr. F. Good, who has superintended the construction of both the ship and machinery, was present on behalf of the owners, and Captain J. E. Murrell represented the builders. On account of the rough weather the trial was only a short one, and, after adjusting compasses, the vessel proceeded to Newport to load for the Mediterranean.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(From our own Correspondent.)

AS was the case last month, few fresh orders have been booked by the shipbuilding and engineering firms here, and as a considerable amount of fresh tonnage has been placed in the water, the yards have a bare look which is very disheartening. Since last writing, we have before us the total output from the Scottish yards, and when you have this in view you will be able to realise to some extent the cause of the visible dulness. During the month of October no less than 19 vessels, registering in the aggregate 38,670 tons, were launched, an output only beaten once during the past ten years, that being in 1888, when over 45,000 tons were launched in the same month. The total output for the last ten months is 226,276, a very fair total, and bearing out our statement at the beginning of the year that the falling off would not be very sudden this year.

Of tonnage launched this month the only vessel which embodied anything exceptional was the auxiliary steam yacht, *John Williams*, built and engined by Messrs. R. Napier & Sons, Govan, for the London Missionary Society's South Sea Mission. She is rigged as a barquentine, and is of the following dimensions:—Length over all, 204 ft.; breadth, 31 ft. 8 in.; depth, moulded, 16 ft., with engines having cylinders 15 in., 24 in., and 39 in., with a common stroke of 27 in. For a fuller description of this interesting vessel we refer our readers to our launch columns. The other vessels launched, though fairly numerous, include nothing worthy of special notice here. Perhaps the only yard which presents a more than usually brisk appearance is that of Messrs. Mackie & Thomson, Govan, and certainly if any firm deserves special notice this firm does, for the excellence and variety of the work they have recently turned out. Messrs. Inglis' large yard at Pointhouse is, we regret to say, looking rather dull, but looks do not go for much, and in the course of a month or two, when one or two of their recently booked orders are more advanced, an alteration will be visible. The lower reaches of the Clyde are looking rather more cheery, though a large clearance will take place, with very little to follow on.

At Leith, Messrs. Ramage & Ferguson have six vessels at present on the stocks, and though Messrs. Morton and Messrs. Hawthorns are very dull, still the employees in the district have little to complain of. Messrs. Scott & Co., Kinghorn, are meeting with the trade which they have taken considerable pains to adapt themselves to, and we will be surprised if this yard does not develop largely in a year or two. The yards on the Tay are decidedly dull, but they make as fair a show as their friends on the Dee.

Coming to new orders booked, Messrs. J. A. Walker & Co., Glasgow, have contracted with Messrs. Russel & Co., Port-Glasgow, for a large four-masted ship of 2,200 tons register, and 3,600 tons cargo capacity. Messrs. Barclay Curle, & Co., of Whiteinch, have booked a new "Hansa" liner of 3,000 tons register, whilst the Fairfield yard opposite is credited with the order for a twin-screw yacht of about 400 tons measurement and 250 ft. long. Messrs. Robert Duncan & Co., Port-Glasgow, are about to lay down the keel of a steel sailing barque of 2,900 tons deadweight capacity. Their near neighbours, Messrs. Blackwood & Gordon, have contracted to build and engine a steel steamship for the City of Dublin Steam Packet Co., of Dublin, for service in their cross-channel trade between Dublin and Liverpool. The engines are to indicate 3,000 H.P., and she will be fitted throughout in a very superior manner for passengers, her outfit to include a complete electric light installation. We have to chronicle the receipt by Messrs. Charles Connell & Co., Scotstown, of an order from Mr. Charles Barrie, Dundee, for the construction of a large sailing vessel of over 3,000 tons deadweight.

The Admiralty have seen fit to place five torpedo-boat destroyers in this district, three going to Messrs. J. & G. Thomson, Clydebank, and two to Messrs. Hannah, Donald & Wilson, at Paisley. Messrs. McKnight & Co., of Ayr, who are at present fairly busy, have booked an order for a high speed steamer for Messrs. J. & P. Hutchieson's French trade. The vessel, which will be of about 1,000 tons register, will be supplied with powerful triple-expansion engines by Messrs. Muir & Houston, Glasgow. The Ailsa Shipbuilding Co., of Troon, have contracted to build for Messrs. Browne & Watson, Glas-

gow, a large sailing ship similar to the *Dalrymple*, built by them a short time ago. An order placed by a Spanish firm with Messrs. J. Scott & Co., Kinghorn, and a steam ferry for the Mersey traffic, concludes our list of bookings for this district. The first-mentioned steamer is for the wine-carrying trade, and is of 1,650 tons register, whilst the ferry, which will run between Birkenhead and Liverpool, is to accommodate 1,200 passengers.

In connection with the recent coal strike a deputation of shipowners and coal exporters waited on the 20th inst. on the directors of the Caledonian Railway with a view to induce the company to increase the loading and berthing accommodation at Grangemouth. The deputation consisted of Messrs. Crawford (James Currie & Co., Leith), John Wilson (Wilson's & Clyde Coal Co., Glasgow), J. P. MacLay, (MacLay & McIntyre), Antony Watson (Lacour & Watson, Leith), D. M. Stevenson. (D. M. Stevenson & Co., Glasgow), and they were informed that their proposals would be favourably considered by the board.

Great hardships are being experienced by the large body of joiners, some 3,000 in number, who have been idle now for two months in connection with the strike over the dispute relative to the overtime bye-laws in the Clyde district. We have already commented on this strike and it is understood that the Secretary of State for Scotland will be approached with a view to arranging a settlement of this most unsatisfactory and disastrous struggle.

It was abundantly evident at the opening of the 37th session of the Institution of Engineers and Shipbuilders on the 24th October, that in electing Mr. John Inglis, of Pointhouse Shipyard, the members considered that they had done the right thing. They were present in unusually large numbers, and the "presidential" by which Mr. Inglis signalised his accession to office was received more rapturously than any opening address for many years; indeed, Mr. Past-President Dundas characterised it as the most brilliant presidential address ever delivered to the Institution.

The second general meeting of the thirty-seventh session of the Institution of Engineers and Shipbuilders in Scotland was held in Glasgow, on the 21st inst. Professor J. Havard Biles read a paper on "The Strength of Large Ships," and in the course of his remarks said he hoped the difficulty of obtaining experimental data upon which to base the resistance due to pitching would be lessened when some experiments now in progress were completed. In future, in large ships, it would be very desirable to carefully consider the reducing of scantlings between amidships and the ends more than had been done, thereby reducing the main stresses. Provision for local stresses must always be made, but the provision should be local, not general, or it might do more harm than good.

The steamer *Wallachia*, built in 1883, and carrying about 2,250 tons, has just been purchased by Messrs. Burrell & Son, of Glasgow. The sale was effected through the Glasgow brokers, Messrs. Thomas Reid & Co. The Clyde Navigation Trustees have placed the contract for one 30 ton weighbridge and one 20-ton weighbridge for the new docks at Cessnock, with Messrs. Henry Pooley & Son, the well-known firm of Albion Works. Messrs. Cayzer, Irvine & Co., of the well-known "Clan" line, have placed an order with the Naval Construction and Armaments Co., of Barrow-in-Furness, for two steel steamers of the following dimensions:—Length, 312 ft.; breadth, 40 ft.; depth, 24 ft. 8 in., to carry 4,100 tons deadweight, at 11 knots.

The South African Mail Service.—The completion of the Royal Mail steamer *Moor*, for the lengthening and refit of which the directors of the Union Steamship Co., Limited, contracted with Messrs. J. and G. Thompson, Limited, of Clyde Bank, has beee delayed by strikes and lock-outs of the joiners and carpenters on the Clyde, but it is anticipated that the vessel will make her first voyage, improved and enlarged, before the end of the current year. The *Moor* as been lengthened 55 ft., and thereby her carrying capacity has been greatly increased. Additional boilers have been supplied and improvements in machinery made, thereby considerably increasing her power, which, it is anticipated, will enable her to steam at a high speed. Advantage has also been taken of the lengthening of the vessel to effect alterations and improvements in the *Moor's* passenger accommodation, the whole of which has been thoroughly renovated, while the construction of large smoking rooms, drawing room, large deck cabins, &c., will, it is believed, make her one of the most popular vessels in the South African trade.

TRADE NOTES FROM THE TYNE, WEAR, TEES, HARTLEPOOLS, &c.

(*From our own Correspondent.*)

THE TYNE.

Shipbuilding.—Amid much that is depressing in connection with the shipbuilding industry in this district, the announcement that the Palmer's firm has been successful in gaining a share of the recently-issued Government contracts, has come most opportunely to impart some cheerfulness to the business outlook. The three torpedo destroyers, for which the Jarrow firm will supply the machinery as well as build the hulls, do not, however, complete the list of additions that have recently been made to the order book, as the firm have contracted to build a large vessel for Cardiff owners. There are several vessels on the stocks of the company's yards at Howdon and Jarrow, amongst which may be mentioned one of very large tonnage, which is to reinforce the number of the "Hall" line of steamers. Some important changes proposed to be carried out in the management of the Palmer Company were submitted and approved of, at a meeting of shareholders recently held in Newcastle, and the belief is entertained that under the new arrangements, the business of the company is likely to attain a degree of prosperity that has not been approached for some years past. The Elswick yard of Messrs. Armstrong, Mitchell & Co. is just now very slack, and matters have been made temporarily worse by an accident to the plate bending rolls, which has had the effect of partially stopping the plating work on a large cruiser. It is stated that there is some work of an important kind in preparation, and that an improvement in business is likely to be felt after the year closes. The long continued slackness at the company's Walker yard has given rise to much speculation as to probable prospective changes, but as yet nothing has been done, apart from the discharging of workmen when their services were no longer wanted, excepting the suspension of some members of the official staff. This is an unusual step, and is certainly not calculated to raise the hopes of those residents in the neighbourhood whose interests are vitally bound up with the prosperity of this old establishment. In former slack periods Messrs. Armstrong, Mitchell & Co., were in the habit of putting down vessels on the speculative principle, to keep as many as possible of the hands employed; but they can scarcely be expected to do this on the present occasion, seeing that two vessels are on the stocks, which are said to be unsold. This circumstance, it may be added, is sufficient to account for the unprecedented slackness now existing in the yard. Messrs. Hawthorn, Leslie & Co. have two large vessels in course of construction, for local owners, and the splendid steamer which they are building for the owners of the Russian Volunteer Fleet is so far advanced in plating, as to make it probable that the launch will take place early next year, if not sooner. Messrs. R. Stephenson & Co. are not particularly busy, having only two vessels in hand, besides some dock gates, the construction of which is practically completed. At the yards of Messrs. Wigham Richardson, and Messrs. Swan & Hunter, however, brisk business is still apparent, and in both cases keels for large vessels have just been put down. A report is current that the latter firm have received an important order from Messrs. Huddart, Parker & Co., of Melbourne, but we are not in a position to say whether the rumour is founded on truth, or otherwise. A dispute between the carpenters and joiners, having reference to the apportionment of work, has caused the firm some inconvenience, the former body having been on strike for three weeks in connection with the matter. The dispute having been brought to a close by a friendly conference of representatives from the parties interested—presided over by G. B. Hunter, Esq.—an arrangement has been come to by which such differences will in future be settled without the resort to such an extreme measure as has been adopted by one of the parties on this occasion. At the Tyne Shipbuilding Co.'s yard activity is still the feature, and the Edwards' Shipbuilding Co. have enough work on the stocks to ensure a continuance of steady trade for some time to come. Messrs. Readhead & Sons have recently placed the keel for a vessel of large size, and two others of equal dimensions are in different stages of construction on the stocks. The large graving dock connected with the yard is kept pretty constantly occupied with vessels undergoing repairs. With the exception of Messrs. Rennoldson's establishment, the yards at North and South Shields, which are

devoted to the building of fishing vessels and other small craft, have been touched pretty deeply by the prevailing depression, as is evidenced by the empty state of the berths. The yard named, however, is as busy as could be wished, the work in progress including two cargo boats for the coasting trade, as well as tug boats, trawlers, and other vessels. Repairing yards have been somewhat slack lately; but the damage caused by the recent heavy weather is known to be serious, and work for the repairing establishments is likely to be more plentiful soon.

Engineering.—In the marine engineering industry there is little change to note since last month; but in the Palmer Co.'s engineering department the outlook is better, particularly in the boiler shops, where a considerable accession of work is said to have taken place lately. Among other establishments that are fairly well employed, may be mentioned the St. Peter's Works of Messrs. Hawthorn, Leslie & Co.; the Neptune Works, Low Walker, and Messrs. Readhead's works, South Shields. The remaining marine engine works are slack and one or two are practically inoperative. The large establishment of Messrs. Clark, Chapman & Co. is kept fairly busy in almost all the departments, a circumstance which is not a little remarkable, seeing that the firm are principally, if not exclusively engaged in the production of specialities connected with the shipping industry, which is now in anything but a prosperous condition. The productive facilities of the firm are of course of the most effective description, which no doubt is sufficient to account for the maintenance of steady trade in a time of such general depression. The plate mills, foundries, and general engineering departments of Messrs. John Spencer & Co.'s works at Newburn, are just now showing considerable activity, and at the Oushburn Forge belonging to the firm, business is moderately good. The Jarrow Forge and Engineering Works are doing fairly well, but most of the other forging establishments are short of work. Mr. W. F. Snowdon, of 32, Side, Newcastle, is at present engaged in covering with patent non-conducting composition the steam pipes and boilers of the large oil steamer *Snowflake*, recently launched from the yard of Messrs. Armstrong, Mitchell & Co., and he has other contracts to proceed with when the ships are ready. Mr. Snowdon has taken up the agency for the sale of the "Manchester" steam trap, the "Norris Combined Separator," and other specialities, in introducing which his extensive local business connection will doubtless be of material advantage.

Messrs. William Reid & Co., of 112, Fenchurch Street, London, are just now showing at their Newcastle depot a most attractive assortment of ornamental brass tubes for decorative work in steamers' saloons, &c., as well as some beautifully finished copper tubes for locomotives, all of which have been manufactured by Messrs. Grice, Grice & Son, Birmingham, for whom Messrs. Reid & Co. are the Newcastle agents. Such specimens of brass work are not often seen in this district, and it is therefore not surprising that since being on view they have attracted a good deal of attention. Messrs. Reid & Co. continue to do a large local business in the sale of their patent reducing valves, lubricators, and pulleys, for which (the latter especially) they are now receiving a good number of foreign orders.

The new works erected by Messrs. C. R. Toomer & Co. at the Tyne Dock entrance, are now ready for occupation, and it is probable that the firm will have effected the removal of their business to the new premises by the middle of December. The works having been specially constructed with a view to the fulfilment of modern requirements in ship, engine, and boiler repairing, will start under very favourable auspices.

Messrs. Toward & Co., of the St. Lawrence Engine Works, have commenced the manufacture of a new pump, which has been designed and patented by themselves. It is specially applicable to marine purposes, and being both cheap and effective will doubtless be largely adopted.

Messrs. George Noble & Co., of 40, Westgate Road, Newcastle, who some time ago were appointed the local representatives of Messrs. Stone & Co., London, have been successful in obtaining some important orders for specialities manufactured by the firm.

Messrs. Proctor & Son, Side, continue to experience a tolerably active demand for ventilators and other steamship accessories, and their works at Wallsend are kept pretty busy. The demand for the anti-corrosive composition for marine boilers, known as Zynkara, is steadily increasing, and the manufacturers are contemplating a further extension of their premises.

Electric Lighting.—Messrs. J. H. Holmes & Co. have recently completed the lighting throughout by electricity, of Mr. Gordon Bennett's splendid steam yacht, *Namouna*, while she was being fitted with new machinery at Liverpool, the lights being arranged for decorative as well as the more useful purposes. The plant used consisted of a Belliss compound engine, developing upwards of 20 brake H.P. under a steam pressure of 160 lbs. per square inch, coupled direct to a "Castle" dynamo of the gramme ring armature type. The coupled plant running at the slow speed of 250 revolutions per minute gives a remarkably high efficiency. A battery of accumulators is charged from the dynamo, capable of supplying 27 sixteen C.P. lamps for eight hours, by which means the lights may be used at any time of the day or night, whether the dynamo is, or is not running. These accumulators are of the high discharge type in teak boxes, and further cased in with teak to prevent any possibility of damage being caused through leakage of the acid. The luxuriant saloon is brilliantly lighted by a handsome 6-light electrolier of polished brass, arranged in such a way that candles may be used if at any time preferred to the electric light, as for instance, when a more subdued light is required. In addition to this there are ten brackets of similar design to the electrolier, arranged at suitable distances on the bulkheads. The cabins, state-rooms, &c., are lighted in an extremely tasteful way, the lamps in the staterooms being covered with art silk shades. The lights in the engineers and officers' quarters, as indeed, in all other parts of the vessel, are very effectively arranged. On the bridge is placed a powerful search-light which may be turned in any direction, either horizontally or vertically. This may be used when navigating rivers, or in, the Suez Canal, as it meets all the requirements of the company. Besides the lights already mentioned, festoons of lamps are hung in the rigging, being so fixed as to be easily taken down and stowed away, when the vessel is at sea. A special feature in connection with the lighting of this vessel, is a small and entirely self-contained installation in the steam launch. This consists of a small engine and dynamo (coupled direct as in the larger plant), working a diminutive search-light which, like the more powerful one on the yacht, can be moved about in any direction. The electricity generated by the main dynamo is, it may be added, utilised for other purposes as well as lighting. The saloon, state-rooms and deck-houses are thoroughly and efficiently ventilated by fans driven by electro-motors placed out of sight in the wells, or made portable, so that during the excessively hot weather usually experienced in certain latitudes, the occupants of the yacht may enjoy an artificial but no less refreshing sea breeze, even in their cabins. This, however, does not complete the number of novel uses to which the electrical power is in this instance applied, for if music is desired, it can be immediately produced by turning a switch acting upon a small motor which, when started plays the piano in the saloon, without the intervention of hands. By way of variety, however, the motor may be disconnected, and the piano played in the ordinary way. Nothing in short has been left undone to render this installation in all respects unique, and we have little doubt that it will greatly enhance the already high reputation of the firm which has carried it out.

THE WEAR.

Shipbuilding.—Since last month a slight improvement is to be noted in the local shipbuilding trade, one yard which had been idle since the beginning of the year, having been reopened, and a considerable accession of work having been obtained at another. The yard first referred to is Messrs. Osborne & Graham's, where two large vessels are now in course of construction, both being necessarily in early stages, the initiatory work having been only recently commenced. The other establishment indicated is Messrs. Wm. Doxford & Sons, which well-known firm has been successful in obtaining an order for two torpedo destroyers, from the Admiralty. The machinery for these vessels is included in the order, and as they are to have a speed of 27 knots per hour, this part of the contract is an important item. This is the first Government shipbuilding order that has come to the Wear for many years, and Messrs. Doxford are to be congratulated on having received such a well merited recognition of their capabilities as builders of ships and engines. The firm have also been commissioned to build other two large vessels of the "Turret" type, the distinctive features of which, as compared with vessels of the ordinary type are increased carrying capacity, combined with increased safety in navigation. Another vessel which is being built by

the firm and is in an advanced stage, is a cargo boat of the very largest size, which, when completed, will doubtless be looked upon as a unique specimen of her class. It will be seen from the foregoing that the state of matters at Messrs. Doxford's establishment, as regards present and prospective work is, in the present condition of the shipbuilding trade, extremely satisfactory. At Messrs. Short Brothers, and Mr. Laing's yards, business keeps fairly active. The graving dock connected with Mr. Laing's yard has been pretty constantly occupied since its re-opening after having been lengthened 40 ft. The docking and undocking of vessels can now be accomplished with much greater speed than formerly, as the dock can be emptied in much less time by the powerful centrifugal pumping engine that has been fitted. This engine, which has given the fullest satisfaction, has been supplied by Messrs. Drysdale & Co., of Glasgow. The Sunderland Shipbuilding Co. have in the framing stage, a large cargo boat ordered by a Newcastle firm, and Messrs. Bartram & Haswell have a vessel of similar type in a more advanced stage of construction. At the North Sands yard, the briskness which existed throughout the greater part of the year has somewhat fallen off, and so far as the state of business is concerned, it is to be feared that at this establishment the year will not close so well as it began.

Engineering.—Several vessels have been engined at Mr. Dickinson's Works, Palmer's Hill, during the last couple of months, and it is probable that when the work turned out from the various local establishments during the current twelve months comes to be reckoned up for purposes of comparison, the business done at these works will be found to be up to, if not in excess of, the average. At present there is a fair amount of new work in the shops, but there is not much doing in the way of repair work. It is understood, however, that a Spanish vessel will shortly arrive at the works to be fitted with new boilers, and to have the engines examined and repaired if necessary. The Southwick Engine Works keep fairly busy, and at Messrs. Doxford's works the tendency is in the direction of improvement. The Monkwearmouth Ironworks are in tolerably active operation, and local foundries are rather busier than they have been recently. Mr. A. A. Rickaby is receiving numerous inquiries respecting his recently-introduced method of cooling condensed water, and utilising the same for boiler feed purposes. We believe that he has already arranged for the installation of this system at a Durham colliery, and other orders are likely to follow. Mr. William Laing, a local engineer and inventor, has patented a new form of ring and spring for pistons, which he is about to place upon the market. It is double-acting, the upward and downward movement being obtained by an ingenious arrangement of spiral coils placed at suitable distances between the two sections of the ring, and fixed to the latter by means of small brackets. It has the essential merits of being effective and economical, and is pretty certain to be largely adopted. Messrs. Dawson & Usher, rope manufacturers, Hendon Road, continue to be kept well employed on orders connected with the equipment of steamers and sailing ships, a class of work which they have made a speciality.

The Hartlepools.—The shipbuilding yards at this centre continue to have a fair share of work on the stocks, and the repairing resources of the port are also being pretty fully utilised. The various departments of Messrs. Thomas Richardson & Son's Engineering Works are kept in steady operation, though the volume of work is very far from being so great as to tax the resources of this well appointed establishment. At the Central Marine Works the state of business has undergone little change within the past few weeks, and may on the whole be described as fairly satisfactory.

Stockton.—We are pleased to be able to state that Messrs. Craig, Taylor & Co., of the Thornaby Yard, have secured an order for two large steamers for the Hamburg and South American trade, and the yard, which has been closed for a short time, will be again in operation very shortly. We note from an American source, that the new oil tank steamer *St. Helen's*, which was built by Messrs. Craig, Taylor & Co., and engined by Mr. Dickinson, of the Palmer's Hill Works, Sunderland, has the credit of being not only the largest and swiftest tank steamer afloat, but is commanded by one of the youngest steamship captains in the Atlantic trade. This is Lieut. Ryder, R.N.R., who will celebrate his 23rd birthday next St. Andrew's day. The ship carries 2,850,000 gallons of oil in bulk, which is said to be 150,000 more than the next largest. The little oil carrying sailing ship *San Ignacio de Loyola*, also built by this firm, and which attracted considerable attention when launched a few months ago, has made a very smart voyage from San Sebastian (Spain) to Philadelphia, occupying only 19 days, which performance pleased the owners greatly. Messrs. Ropner & Son are, we understand, commencing the construction of a vessel on the speculative principle, with a view to keep a number of the workmen employed. Messrs. Blair & Co. have fitted with their machinery the undermentioned vessels which had their trial trips during October :— The s.s. *Dulwich*, built by Messrs. Ropner & Son, Stockton, for Messrs. Watts, Ward & Co., of London, having engines with cylinders 23½ in., 39 in., 64 in., by 42 in. stroke. The s.s. *Finsbury*, belonging to the same owners, an old vessel fitted with new triple-expansion engines with cylinders 20 in., 33 in., 54 in. by 36 in. stroke. The s.s. *Kansas City*, built by Messrs. John Blumer & Co., Sunderland, for Messrs. Chas. Hill & Son, of Bristol, having engines with cylinders 23½ in., 39 in., 64 in, by 42 in. stroke. The three sets of engines were constructed to work at 160 lbs. steam pressure, and on the trial trips gave complete satisfaction.

Middlesbro'.—Messrs. Craggs & Sons have secured an order for a steamer to be employed in the coasting trade, and have two good-sized fruit boats on the stocks. Messrs. Harkess & Son having just completed extensive repairs to a foreign steamer, are now less busy than they were last month. Messrs. Raylton Dixon & Co. have obtained a small addition to the work in hand, but that is exceedingly limited, and there is only a small proportion of the hands employed.

Darlington.—The Darlington Forge Co. have received an order from the Admiralty direct for steel castings for H.M.'s ships *Magnificent* and *Majestic*, each of which will be of 14,000 tons displacement. The castings consist of two rams to weigh 30 tons each, two stern-frames to weigh 12 tons each, and two rudder-frames to weigh 15 tons each.

Consett.—The Consett Co.'s Steel and Iron Works have, after a somewhat prolonged stoppage in certain departments caused by the scarcity of water, again resumed operations on a scale which pretty nearly approaches to full work. The company's collieries have worked uninterruptedly throughout the whole period of the stoppage in the iron and steel works.

MERSEY NOTES.

(From our own Correspondent.)

THE only event of special interest to record during the past month is the settlement come to with regard to the protracted dispute in the coal trade, but although the conflict has ceased, and the pits have resumed work, there is a very general apprehension that the struggle has by no means been brought to an end. Both sides are still as widely at variance as ever upon the questions at issue during the stoppage of the pits, and although they have agreed to a Board of Conciliation, with an independent chairman, which is practically referring the whole matter to arbitration, it will largely depend upon the chairman who may be appointed as to whether any satisfactory final settlement of the question of wages will be even by this means arrived at. In some quarters there are anticipations that the whole matter will, early on in next year, have to be fought out again, and that the settlement arrived at can only be regarded as a temporary truce. For the present, however, the resumption of work at the collieries is a matter of intense satisfaction to all the large coaling branches of industry, which have suffered so disastrously during the four months' stoppage of the pits, and it will take some time to recover from the effects of this coal trade dispute. All branches of the engineering trade have suffered severely, both as regards employers and workmen. In every department there has been steady running out of work, with very little new coming forward, further orders being held in abeyance until some settlement of the coal trade dispute could be arrived at. Amongst marine engineers, the position has remained extremely depressed, with little or nothing in the way of new work of any kind coming forward, beyond occasional repair jobs of no special moment. Machine tool makers have only in very exceptional cases had any weight of work to go on with, and very little new coming forward, and boiler makers have reported a steadily decreasing weight of new orders going out. With regard to the shipbuilding industries, the position remains very much the same as reported last month, the outlook as regards new work coming forward being anything but hopeful, and the prospects are certainly of very dis-

couraging character. With regard to employment, the effects of the stoppage upon the resources of the Trades Union organizations must have been very disastrous. In this immediate district the Amalgamated Society of Engineers has had from ten to twelve per cent. of its local membership almost constantly in receipt of out of work support, whilst the general returns for the whole of the Society showed for the past month quite nine per cent. of the total membership in receipt of unemployed benefit. The Steam Engine Makers' Society, although in a better state, has had a larger percentage than for some time past, in receipt of out of work support, and altogether the coal stoppage must have entailed a very heavy expenditure on the part of both organizations in out of work benefit to members who have been temporarily thrown out of employment, entirely as the result of the stoppage of the pits.

A very handy cotton cord or flying rope travelling crane, has been designed by Messrs. Barrington & Sainsbury, of the Soho Iron Works, Manchester, which is specially suitable for wharves and iron founders. In this arrangement the motion is taken from the flying rope by grooved pulleys, and transmitted by belts to the lifting, travelling, and traversing motion. All the gearing is fixed at one end of the cross girders, which are of rolled iron or steel, or built up plate girders, as may be required, secured to and carried by strong cast-iron end carriages, having double flanged cast-iron tread wheels. The lifting motion is arranged with two speeds, a slow speed for heavy weights, and a quick speed for lighter weights. Instead of all the lifting motions being contained in a travelling crab, running on girders, its place is taken by a "travelling bogie," racked to and fro by means of chain, and pitch chain wheel, for the traversing motion. The hoisting gear is "self-sustaining," and the crane is worked by the operator, sitting in a cage, with all gear and motions perfectly under control.

In the iron market the settlement of the coal dispute has given a more hopeful tone with regard to the future, but as yet there has been no very largely increased weight of new work giving out. It will take two or three weeks before the pig iron furnaces which have been blown out can again get into blast, and the ordinary output of the local and district furnaces can scarcely in any case get on to the market until towards the end of the year. Finished iron works have been gradually restarting during the past week, but in some instances the question of obtaining supplies of forge pig-iron has considerably interfered with getting back into operation, and this will be a serious difficulty until the blast furnaces are again sending out their average production. For the present, prices are difficult to quote definitely, as there are so few brands actually offering in the market. Lancashire makers, of course, have nothing yet to offer, and the one or two Lincolnshire makers who have kept their furnaces going are fully sold over the remainder of the year, the only district brands just now available being Derbyshire, which are firm at about 43s. 6d. to 44s. for forge, to 50s. for foundry, net cash, delivered in this district. With regard to outside brands, there is practically little or nothing obtainable except Middlesbrough, which is quoted at about 43s. 4d. net cash, for good foundry qualities, delivered here. Only a few small odd parcels of Scotch iron are obtainable from merchants, and these are confined to practically one brand. Eglinton, for which about 48s. net, prompt cash, at the Lancashire ports, is being asked. The present scarcity of Scotch iron has been caused by makers sending nothing forward during the coal stoppage, owing to the vessels being largely engaged in carrying fuel, with the result that freights have been altogether too high to be paid upon iron. Another reason, which has probably affected the sending of Scotch iron to the ports on the Mersey is that with the opening of the Ship Canal, special arrangements will be made for storing iron at points much nearer to Manchester, which will probably save about 1s. 6d. per ton on the carriage, and this is necessarily a consideration which will prevent any further considerable accumulation of stocks at the present ports on the Mersey.

In the steel trade, business has been very quiet all through the month, with a weakening tendency in hematites, which except for very small parcels, do not average more than 58s., less 2½, delivered in this district. With regard to steel boiler plates, makers who have been taking about £6 5s. to £6 7s. 6d. for forward delivery, are showing more firmness, and they have stiffened up to about the current quoted rate of £6 10s. for good qualities, delivered to consumers in this district.

In the finished iron trade, local makers are again quoting in the market, but prices at present are rather variable, until the production gets again into something like its normal condition. In some instances, makers have been asking as much as £5 17s. 6d. for bars, whilst others would sell at £5 12s. 6d. to £5 15s. Hoops remain without quotable change from the prices ruling prior to the stoppage, random lengths being quoted for export at £5 17s. 6d., and special cut lengths £6 2s. 6d., delivered in Liverpool. For sheets, makers are asking from £7 5s. up to £7 10s. per ton.

In the metal market business has continued very quiet, without any really material quotable change in prices, which remain about as under:—Solid drawn brass boiler tubes, 5½d.; solid drawn brass surface condenser tubes, 7d.; solid drawn copper tubes, 7¼d.; brazed copper gas and steam tube, 7d.; brazed brass gas tube, 6¾d.; brazed brass machine tube, 6½d.: brass wire, 5½d.; copper wire, 6½d.; rolled brass, 5d.; yellow metal bolts, 5½d.; yellow metal condenser plates, 5½d.; cast composition sheathing nails and spikes, 5¾d.; cast red metal sheathing nails and spikes, 7½d.; wrought copper rivets, 8¼d.; wrought copper boat nails, 8¼d. to 9¼d.; cut copper nails, 8d. to 9½d. per lb., and copper bolts, £61 per ton.

With regard to the timber trade, there is very little change to report. Imports have perhaps been rather heavier, but not excessive, and considering that the demand has been somewhat affected by the coal strike, deliveries have been fair. Values generally are unchanged, and stocks of all articles are sufficient. Of East India teak a few parcels of planks have arrived and for prime qualities rather better prices have been made, but on the whole the demand is only dull, with very little change in the market, and stocks are still fairly moderate. Of greenheart there has been nothing coming to hand, and with the demand only very limited, and stocks excessive, prices tend downward.

With the settlement of the coal dispute prices have been gradually getting back to something like old rates, and immediately following the restarting of the pits, there was a meeting of the principal coalowners throughout South Lancashire, at Wigan, when a temporary basis of pit prices was agreed to, of 17s. 6d. for best Wigan Arley coals, 15s. Pemberton four ft., 13s. 6d., Ince four ft., 10s. to 11s. burgy, and 8s. to 9s. for engine fuel, which brought rates back to within 5s. of those ruling prior to the stoppage; but this was subject to further revision at the meeting to be held in the following week. The representatives of the principal colliery concerns in the Manchester district also had a meeting on the following day, and brought prices back, on round coal, to within 4s. and 4s. 6d, and upon manufacturing classes of fuel, within 2s. 6d. and 3s. per ton of the rates current when the stoppage commenced, their pit prices being fixed at about 17s. 6d. to 18s. for best coals, 16s. 3d. for seconds, 12s. 6d. for common coal, 10s. for burgy, and 9s. for slack. These, however, were only temporary prices, until further meetings could be held in the ensuing week.

NORTH-WEST OF ENGLAND.

(From our own Correspondent.)

Barrow.—November has been a very quiet month in the shipbuilding and engineering trades, and the enquiry for new tonnage is very limited. The only orders of any moment which have been booked during the month are those given to the Naval Construction and Armaments Co. by Mr. Cayzer, M.P. for Barrow, as managing owner for Messrs. Cayzer, Irvine & Co. These orders embrace the contract for two 4,000 ton steamers for the Clan Line, which will be employed mainly as cargo carriers to the East Indies. This new work is particularly acceptable at a time when the work in the great Barrow yard was so limited, and when so many men in the various departments of the shipbuilding trade are out of work. Mr. Cayzer, however, while placing orders at a time like this not only furnishes much employment to workpeople, but he will secure two valuable trading steamers at a cheap cost. Labour and material are now very low, and those who build now will certainly secure a great advantage whenever an improvement in trade sets in. The Clan Line have had seven of their present fleet of steamers tripled at Barrow, and they are thus in a position to work economically and profitably, as compared with other steamers employed in the same trade which are propelled by the old type of engines. There is a general tendency among shipowners to triple all old steamers, whose hulls are worthy of the cost, and in cases where they are not sound enough to be tripled they are likely soon to be broken up. But there will not

be much done in the breaking up of old steamers until better prices can be obtained for material. This is, however, not considered wise policy, because the old steamers cannot now be worked at a profit, and the sooner they are broken up and turned into money the better. This policy would clear shipping of a lot of useless tonnage, and this would encourage the building of new ships, which would in turn tend to increase the value of material. The Naval Construction and Armaments Co. has now on the stocks in their yard a 6,000 ton steamer for Messrs. Royden, of Liverpool, and also a screw steamer for the British and Irish Steamship Co. Now they have two Clan Liners to put down, and although trade is very bad and the demand for new tonnage small, there is reason to believe that further orders of some importance will be placed before Christmas, and that the New Year's trade will be a much better one than that of 1893.

Shipbuilding Material.—There is but a poor enquiry for steel shipbuilding material, and local makers have not booked any orders during the month. It is, however, satisfactory to learn that the experiments which have been undertaken at the Barrow Steel Works lately for the production of steel plates direct from the Siemens Martin's furnaces at one heat have been remarkably successful, as explained in last month's MARINE ENGINEER. The metal is cast in ingot moulds shaped very much like a slab, and when the metal in these moulds solidifies in soaking pits, heated by produce gas the ingots are taken to the plate mills direct, and there rolled straightaway into plates. The saving in the cost of fuel will be considerable, and this fact will enable local makers of shipbuilding qualities of steel to produce plates, angles, channels, and other sections at a profit, that at present is impossible because the cost of fuel is so great. Plates produced by this process have met all tests of the Admiralty, Lloyd's, &c., and there can be no doubt that the plates are as good, as sound, and as reliable as those produced by the present process by means of the employment of slabbing mills, and the reheating of ingots. Barrow is very favourably situated for this trade, as cheap deliveries can be made by sea to Liverpool, Belfast, and the Clyde, as well as to the large shipbuilding yards at Barrow, and these sources of demand should afford plenty of trade, especially as the best possible raw material for the manufacture of steel abounds in hematite iron-ore deposits of the Furness district.

West Cumberland.—There is a fairly steady trade in shipbuilding at Workington and Maryport, but vessels in this port are not generally built to order. They are sold to private owners when built in sixty-fourths, and their is always plenty of enterprise in the locality to acquire the sailing ships which are built by local firms, and afterwards employed in the shipping trade of the world. Probably West Cumberland builders are less influenced by the ups and downs of shipbuilding trade than other builders in other parts of the country, whose work is wholly influenced by supply and demand.

North-East Coast Institution of Engineers and Shipbuilders.—The tenth session of the Institution was formally inaugurated on the 24th of October by a conversazione, provided by the President, Mr. Robert Thompson, J.P., senior partner of the firm of Messrs. Joseph L. Thompson & Sons, of the North Sands Shipyard, Sunderland, in the Assembly Rooms, Westgate Road, Newcastle. There were about seven hundred ladies and gentlemen present, the rooms were open *en suite*, and had been specially prepared for the occasion, being charmingly decorated with screens, palms, ferns, and other greenhouse plants, and brilliantly lit up with the electric light. A large contingent of guests journeyed to and from Sunderland in a special train run for their convenience. The President and his amiable wife welcomed their guests in the Reception Room, and among those received were three past Presidents, Messrs. W. Theodore Doxford (Sunderland), F. C. Marshall (Tynemouth), and Wigham Richardson (Walker-on-Tyne); Vice-Presidents Messrs. John Price, John Gravell, and W. Kilvington; Councilmen, Messrs. Henry Fownes, W. Hök, M. C. James, Hugh McColl, Professor R. L. Weighton, M.A., D. B. Morison, W.C. Mountain, Edwin W. de Russett, J. W. Reed, W. G. Spence, T. Mudd, Jas. Patterson and J. C. Stirzaker. Among others were the Mayor and Mayoress of Gateshead, Alderman and Mrs. Sutton, Alderman and Mrs. Furness, Councillor Flowers, Dr. and Mrs. Spence Watson, &c. A concert was provided by Mr. J. H. Amers' band and the following vocalists: Miss Lizzie Sneath, Mr. L. C. Guthrie and Mr. W. Lyall, who rendered solos and duets in artistic style. At nine o'clock the President formally declared the tenth session open and after a few genial remarks, presented the gold medals to the authors of the two best papers read last session by members other than Councilmen, who are excluded by the rules. The shipbuilding medal was handed to Mr. Stonard O. Kendall (Bureau Veritas), and engineering medal to Mr. J. Denholm Young (North-Eastern Marine Engineering Co., Limited). On the motion of Mr. Wigham Richardson, a cordial vote of thanks was passed to the President. Dancing then commenced and proceeded till midnight. Refreshments were provided throughout the evening in the lower hall. Mr. John Duckitt, the secretary of the institution, had everything well arranged for such a large gathering, and under his and the following stewards' fostering care the company appeared to thoroughly enjoy themselves:—J. Brentnall Duckitt, A. J. Farina, R. L. Gaine, F. Graham, J. Gravell, J. Hunt Hedley, J. G. Jordan, J. Marr, W. Mills, G. W. Sivewright, and W. F. Snowdon.

The Junior Engineering Society.—On Friday evening, Nov. 10, at the Westminster Palace Hotel, the inaugural meeting of the thirteenth session of this Society took place, and was largely attended. The retiring President, Dr. John Hopkinson, F.R.S., took the chair at the commencement of the proceedings, and after some formal business had been disposed of, presented the Society's premium to Mr. R. W. Newman for his paper on "The Sanitary Engineering of Dwellings." A vote of thanks having been cordially passed to Dr. Hopkinson for his services as President, the new President, Mr. J. Wolfe Barry, Vice-President Inst.C.E., was then introduced and proceeded to deliver his Presidential address. In it, Mr. Barry claimed for the engineering profession an equal position with that of other professional bodies, and suggested means whereby its status might be improved. He referred to the remarkable progress of engineering during the past 40 or 50 years, and to its beneficient influence on the condition of mankind, concluding with a review of the directions in which it would doubtless achieve fresh triumphs. The thanks of the Society having been heartily expressed to the President for his address, the meeting terminated with the announcement of the ensuing meeting, when a paper will be read by Mr. S. Cutler, jun., on "Coal Gas Manufacture, and recent improvements in the plant employed therein." Other papers in the session's programme are "Boiler Incrustations and Deposits," by Professor V. B. Lewes; "The Construction and Working of Electro-Motors," by Mr. A. H. Dykes; "The Design and Construction of Boilers for Locomotive Engines," by Mr. G. F. Burtt; "Lubricants, their use, testing, and analysis," by Mr. W. F. E. Seymour; "The Industries of Devon and Cornwall," by Mr. F. R. Taylor; "Marine Engineering Repairs," by Mr. T. P. Howgood. Visits to works take place between the meetings, the papers read and accounts, of the visits being printed in the Society's record of transactions. We may add for the information of any of our readers desiring particulars of membership, that the address of the Secretary is 47, Fentimore Road, S.W.

A Bit of Ancient History.—Mr. O. C. Lacy, of San Francisco, writing to *The Engineer* of New York, calls attention to an interesting relic yet in existence at Burrards' Inlet, British Columbia, viz., the remains of the old Hudson Bay Co.'s steamer, *Beaver*, built by Messrs. Green, of Blackwall, London, in 1835, and launched in that year in the presence of King William and 160,000 of his subjects. Her engines and boilers were built by Messrs. Boulton & Watt, of Birmingham, and were of the side lever type, 35 H.P., each with double cylinders, 36 in. diam. by 36 in. stroke. Her boilers carried a steam pressure of 5 lbs. per square inch, and were of the old "leg type," and not easily got at for repairs. The *Beaver*, rigged as a sailing vessel, and accompanied by a convoy, left England for the Pacific Coast in 1835, and after a long and tedious passage of 163 days, she arrived at Astoria, Oregon, in February, 1836, being the pioneer steamship of the Pacific. It was related to Mr. Lacy by her old captain that it was quite a common occurrence to stop at sea and raise the cylinder covers to repack the pistons, and that he often had to run up close to a landing and wait until there was steam sufficient to blow the whistle. It was customary, whenever a hole was blown in the boiler sheets to fill a sack with ashes to serve as a temporary plug, and they would run for days in this state. The best parts of the hull have now been carried away by curio hunters.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Tyne Belle.—On October 25th Messrs. Edwards Brothers, North Shields, launched the screw steam trawler *Tyne Belle*, built for the Tyne Steam Fishing Co, Limited. The vessel is 110 ft, long, 21 ft. beam, and 11 ft. 6 in. deep.

Murillo.—On October 25th Messrs. John Priestman & Co. launched at Southwick a steel-screw steamer for Messrs. T. Wilson, Sons & Co., Limited, Hull. This vessel will take Lloyd's highest class, and is of the following dimensions:—Length, 312 ft.; breadth, extreme, 39 ft. 6 in.; depth, moulded, 21 ft. 1½ in. Engines of the triple-expansion type will be supplied by Messrs. William Allan & Co., fitted with patent direct steam windlass by Emerson, Walker & Co. The Mayoress of Gateshead named the ship *Murillo*.

Snowflake.—On October 25th there was launched on the Tyne by Sir W. G. Armstrong, Mitchell & Co., a steel screw-tank steamer, built to the order of the Bear Creek Oil and Shipping Co., of which C. T. Bowring & Co., Liverpool, are the managing owners. The principal dimensions of the vessel are:—Length, 305 ft.; breadth, 32 ft. 6 in.; depth, 27 ft. 9 in. She has been built on Swan's patent system, and is capable of carrying about 3,300 tons. The vessel, which was named *Snowflake*, will be fitted with triple-expansion machinery.

Nagy Lajos.—On October 25th Messrs. Wigham Richardson & Co. launched at Newcastle-on-Tyne a steel screw steamer, which they are building to the order of the Royal Hungarian Sea Navigation Co. "Adria," Limited, of Fiume and Budapest. The vessel is 285 ft. in length and 38 ft. beam. The engines are of the triple-expansion type. The vessel was named the *Nagy Lajos*.

A New Steam Ferry.—On October 25th Messrs. Willoughby Bros., Limited, launched at Plymouth a steam ferry bridge, somewhat after the style of that plying on the Tamar at Saltash. She has been built to the order of Mr. W. Cuthbert Quilter, M.P., and she is for service at Bawdsey, to run between Bawdsey Manor and Felixstowe, mainly for the private use of the lord of the manor and his household, who will thus be saved a drive of some thirty miles to Ipswich. The bridge, which is to be worked on the chain system, has a pair of surface-condensing engines to a boiler pressure of 100 lbs. to the square inch.

Northdene.—On October 26th there was launched by Messrs. S. P. Austin & Son, at Sunderland, the steel-screw steamer *Northdene*, of the following dimensions:—Length, 240 ft.; breadth, 36 ft.; depth, 17 ft. 7 in. moulded; gross tonnage, about 1,350 tons. The vessel has been constructed under special survey at Lloyd's to class 100 A1, and her machinery will be supplied by Messrs. William Allan & Co. The vessel has been built to the order of Messrs. Sir James Joicey & Co., Limited, of Newcastle, and Messrs. John Fenwick & Son, of London.

Jules Orban de Xivry.—On October 26th Messrs. Cochrane & Cooper launched from their yard, at Grovehill, Beverley, an iron steam trawler which they have built to the order of an Ostend firm. The vessel, which is 102 ft. by 20 ft. 6 in. by 11 ft., will be fitted with all the latest improvements for steam trawling, and will have 50 N.H.P. triple-expansion engines, by Messrs. C. D. Holmes & Co., Hull, and being built on very fine lines is expected to develop a high rate of speed. As the vessel left the ways she was named the *Jules Orban de Xivry* by Mrs. J. Carlill Saville, who gracefully performed the launching ceremony.

Hotham Newton.—On Thursday afternoon, October 26th, Sir Raylton Dixon & Co. launched from their Cleveland Dockyard, Middlesbrough, a steel screw oil steamer which has been built to the order of Messrs. J. M. Lennard & Sons, Middlesbrough, for the purpose of carrying petroleum in bulk. She has been built under special survey to take the highest class in both Lloyd's and Bureau Veritas, and the construction has been carried out under the superintendence of Mr. R. Hartness for Bureau Veritas, Mr. A. B. Wilson for Lloyd's, and Mr. M. W. Ruthven for the owners. The principal dimensions are, length, 322 ft.; beam, ; 41 ft. depth moulded, 26 ft. 6 in. The spar and main decks are of steel, and the poop and forecastle decks of pine, and she will be rigged as a three-masted schooner. The vessel is fitted with 13 transverse bulkheads and a centre line bulkhead running right fore and aft, thus dividing the ship into tanks for the carrying of oil. This is the first oil-carrying steamer built on Kendall's Patent System of Expansion Trunkways for regulating the oil cargoes under varying temperatures. Instead of being fitted on each side of the middle line bulkhead, as heretofore, these expansion trunks are placed at the *sides* of the vessel and thus allow a clear space in the middle of the ship for the stowage of coal or general cargo. Water ballast is provided for in tanks under the engines, boilers, and pump room, and also in the fore and after peaks. A considerable amount of hydraulic riveting has been introduced in the construction of the vessel, and the oil-tightness and watertightness of every portion has been effected by caulking "iron to iron" to the absolute exclusion of either felt or canvas. The oil pumping installation has been fitted by Messrs. Hayward Tyler & Co., of London, and this firm are also fitting the electric lighting arrangements which will extend to every part of the vessel, including the side and masthead signal lamps. For the working of general cargoes the steamer has been supplied with two large steam winches by Messrs. Copley, Turner & Co., of Middlesbrough. The accommodation for the captain, officers, and engineers is provided in the poop aft, and the seamen and firemen are berthed in the topgallant forecastle forward. The whole of the accommodation will be heated by steam, and the cooking is also done by steam, so that the risks from fire are reduced to a minimum. The engines and boilers are placed aft. and these will be fitted by Messrs. The North-Eastern Marine Engineering Co., Limited, of Sunderland, the cylinders being 24 in., 39 in., 64 in. and 42 in. stroke, with two large steel boilers working at 160 lbs. pressure. Amongst those present to witness the launch were Mr. Milner Lennard, Mr. Wm. Lennard, Mr. and Mrs. Arthur Lennard, and a large party of friends, including Mr. A. G. Schaeffer and Mr. R. Hartness, of the Bureau Veritas Register, Mr. A. H. Whipham, Mr. Edward Kirby, Mr. and Mrs. Jaeger, Mr. and Mrs. Robert Stephenson, Mr. and Mrs. Ronnebeck, Mr. J. Frederick Wilson, &c., &c. As the steamer was leaving the ways she was named the *Hotham Newton* by Mrs. Arthur Lennard, of Saltburn.

Edenmoor.—On November 6th there was launched from the shipbuilding yard of Messrs. John Readhead & Sons, West Docks, South Shields, a steel-screw steamer of the following dimensions:—Length, 333 ft.; breadth, 41½ ft.; depth, 24 ft. 4½ in. The vessel is of the partial awning-deck type, with raised deck forward, classed 100 A1 at Lloyd's under special survey, and will be fitted with the latest appliances and improvements for a general cargo steamer, including patent direct steam capstan windlass by Emerson, Walker & Co. The engines, also built by Messrs. John Readhead & Sons, are of the triple-expansion type, having cylinders 24 in., 40 in., and 64 in. by 42 in. stroke, steam being supplied by two large steel boilers having a working pressure of 160 lbs. The vessel will carry over 4,850 tons deadweight. She has been built to the order of Messrs. Walter Runciman & Co., Newcastle-on-Tyne, for whom the above firm have built several steamers. As she left the ways the vessel was named *Edenmoor* by Mrs. Godfrey, of Heaton.

Lindenfels.—On November 8th there was launched from the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesbro', a fine steel-screw steamer of the spar-deck type, which has been built to the order of the Hansa Steam Ship Co., of Bremen. This is a sister ship to the *Rothenfels*, lately launched by the same builders for this company, and as neither of these steamers were commenced until the beginning of July, they have been only a little over four months in construction. The principal dimensions are:—Length, 327 ft.; beam, 41 ft. 9 in.; depth, moulded, 28 ft. 6 in., and she is built to Lloyd's highest class. The spar deck is of steel sheathed with teak, the main deck is of steel, and the poop bridge and forecastle decks are of teak. The vessel has a deadweight carrying capacity of about 4,500 tons, and throughout the holds web frames are fitted in lieu of hold beams. Handsome accommodation is fitted up in the bridge house for the captain, officers, and engineers, and a few passengers, the saloon being of polished hardwood, with artistically inlaid panels. The engines will be fitted by Messrs. Thos. Richardson & Sons, of Hartlepool, the cylinders being 24 in., 38 in., and 64 in. by 42 in. stroke, with two large steel boilers working at 160 lbs. pressure. As the steamer was leaving the ways she was named the *Lindenfels* by Mrs. Lange, of Bremerhaven.

Cam.—On November 8th there was launched by Messrs. Joseph L. Thompson & Sons, at Sunderland, a steel screw-steamer, built to the order of the Mercantile Steamship Navigation Co., Limited, of London, of the following dimensions.

viz.:—Length over all, 333 ft. 6 in.; breadth, extreme, 41 ft. 6 in.; depth, moulded, 24 ft. The vessel is of the partial awning deck type. The engines, which are of the triple-expansion type, are being supplied by Mr. John Dickinson, having cylinders 24 in., 39 in., and 64 in. respectively, with a stroke of 42 in. The vessel was christened the *Cam*.

Loch Tay.—On November 8th there was launched from the Jarrow yard of Palmer's Shipbuilding and Iron Co., Limited, the large steel screw steamer *Loch Tay*, which has been built to the order of the Dundee Loch Line Steam Shipping Co., of Dundee. The vessel is of the following dimensions, viz.:—410 ft. between perpendiculars; 49 ft. beam, moulded; and 33 ft. depth, moulded; and is of the three-deck type, with poop, bridge, and forecastle. She is built under special survey to take the highest class at Lloyd's, and will have the usual fore and aft schooner rig. Two complete steel decks are laid fore and aft. The hull is divided into eight watertight compartments by means of seven steel bulkheads, and a double bottom is fitted all fore and aft, with all the necessary steam pumps and suctions, for using water ballast. The vessel has been designed to carry over 7,600 tons deadweight on a moderate draught, and is fitted with grain trimming hatches, and all the latest requirements for the carriage of grain in bulk. She will be fitted with all the most modern improvements for the rapid loading and discharging of cargoes, and handling of the vessel. The engines are triple-expansion, including all the latest improvements, steam being supplied by two large double-ended boilers, which have also been constructed by the Palmer Co. The ship and machinery have been built under the personal superintendence of Mr. W. L. Gordon, the superintending engineer for the Dundee Loch Line Steam Shipping Co., Limited. The vessel on leaving the ways was christened by Mrs. Robert Leitch.

China.—On November 9th Messrs Cochrane & Cooper launched at Grovehill a line-fishing vessel for the International Steam Trawling Co, Grimsby. The vessel, which is classed 100 A1 at Lloyd's, is 105 ft. long, 21 ft. beam, and 11 ft. 6 in. deep. She was named the *China*.

Woolwich.—On November 9th Messrs. Ropner & Son launched at Stockton-on-Tees a spar-decked steel screw steamer of the following dimensions, viz.:—Length between perpendiculars, 330 ft.; breadth, 43 ft.; depth moulded, 29 ft. 6 in. She will be classed 100 A 1 at Lloyd's, and carry over 5,000 tons deadweight on Lloyd's freeboard. She will be fitted with triple-expansion engines by Messrs. Blair and Co., Limited, of 1,200 I.H.P. The vessel has been built for London owners, and was christened *Woolwich*.

Whitburn.—On November 11th Messrs. Short Brothers launched at Pallion a steel screw steamer, built to the order of Mr. George Butchart, of Sunderland. The vessel has been built to the highest class in Lloyd's register, and is of the following dimensions.—Length, 300 ft.; breadth, 40 ft.; depth moulded 21 ft. 8 in., with a deadweight carrying capacity of 3,800 tons. The vessel, which was named *Whitburn*, is to be fitted with triple-expansion engines by Mr. John Dickinson.

Mikado.—On Thursday, November 23rd, Messrs. Richardson, Duck & Co., launched from their yard a steel, spar-decked screw steamer, of the following dimensions:—Length, over all, 357 ft. 6 in.; breadth, extreme, 43 ft.; depth, moulded, 29 ft. 9 in.; tonnage, gross, about 3,560 tons. This vessel, which has been built to the order of Messrs. Thos. Wilson, Sons & Co., Limited, Hull, is classed 100 A1 on Lloyd's Registry, and has been built under special survey. She has a long bridge amidships with accommodation for passengers, officers, engineers, and firemen, in deck-houses on bridge-deck, an open topgallant forecastle, sailors and petty officers being berthed below spar deck, and a hood aft with iron-house for steering gear and hospital. A cellular double bottom throughout, and peak tanks are fitted for water ballast, the collision bulkhead being made cone-shaped for greater strength. The vessel will be rigged as a two-masted schooner. Messrs. Blair & Co., of Stockton, supply the engines, which have cylinders 23½ in., 39 in., 64 in., and 42 in. stroke, steam being supplied by three single-ended boilers working at 180 lbs. pressure. The owners were represented at the launch by Mr. J. F. Wilkins, who has superintended the construction of the hull, and by Mr. Jno. Spear, the superintendent engineer. The christening ceremony was performed by Miss Stothart, daughter of James Stothart, Esq., of Stockton-on-Tees.

Horsa.—On Thursday, November 23rd, Messrs. Wm. Gray & Co., Limited, launched the fine steel screw steamer *Horsa*, which they have built to the order of Messrs. Herskind & Co., of West Hartlepool. She is the 24th vessel which the builders have supplied to the order of Messrs. Herskind, and is one which will maintain both their reputation and that of the owners. Her principal dimensions are:—Length over all, 324 ft.; breadth extreme, 40 ft. 6 in.; and depth moulded, 23 ft. 8½ in., and her class will be the highest at Lloyd's. The type is that of partial awning deck with raised quarter-deck and poop, and the rig fore-and-aft schooner with telescoping topmasts. Very tasteful and comfortable cabin accommodation is provided under the poop, consisting of saloon, state-room, captain's room, officers' berths, and large mess-room. The engineers' rooms are amidships, and the crew's berths forward. The sides of the vessel are supported by strong web-frames, taking the place of hold beams as far as possible, and leaving a clear hold for stowing bulky goods. A cellular double-bottom is fitted, and also an after-peak tank for water ballast, and the steam windlass, steam steering gear amidships, screw gear aft, steam winches, donkey boiler, and the whole of the outfit are of the improved description. The engines are by Messrs. T. Richardson & Sons, of Hartlepool, on the triple-expansion system, with cylinders 23 in., 38 in., and 62 in. diameter, and 42 in. stroke, and have two large single-ended boilers, 14 ft. 9 in. diameter by 10 ft. long, to work at 160 lbs. pressure per square inch, fitted with Morison's patent furnace and evaporator and latest improvements. The ship has been built under the superintendence of Capt. Petersen, and the machinery under that of Mr. J. R. Fothergill, on behalf of the owners. The ceremony of naming the *Horsa* was gracefully performed by Mrs. Steel, of Seaton Carew.

St. Brieuc.—Messrs. John Jones & Sons have launched at Brunswick dock, on the Mersey, the steel screw-steamer *St. Brieuc*, which has been built for the passenger coasting trade between Havre and St. Brieuc, for French owners. Her engines are triple-expansion, and are intended to propel the vessel at a speed of 11 knots.

LAUNCHES—Scotch.

Lackawanna.—On October 26th there was launched from the shipbuilding yard of Messrs. David J. Dunlop & Co., engineers and shipbuilders, Port-Glasgow, the s.s. *Lackawanna*, built to the order of the Anglo-American Oil Co., London, for carrying petroleum oil in bulk, for which the vessel has been specially designed, being divided by strong thwartship bulkheads into ten oil-tight compartments, which are again subdivided by a longitudinal bulkhead in the middle line of the vessel; these compartments have all been separately tested in the presence of the owner's and Lloyd's surveyors, and under the most severe pressure to which the bulkheads will ever be subjected, each compartment proved itself thoroughly satisfactory. At the forward and after end of the oil compartments is a 4-ft. well extending the full breadth of the vessel, and carried up to the height of the spar deck; the well also satisfactorily stood the same test as applied to each oil compartment. The fore hold, fore peak, and after peak, and tanks under the engines and boilers—the latter built on the cellular principle—are all arranged for carrying water ballast for trimming purposes. The *Lackawanna* is fitted with all the latest improvements to suit her special trade, including Clarke Chapman's combined steam capstan windlass, steam warping winches, Muir & Caldwell's steam steering gear, electric light fittings throughout by Holmes & Co., of Newcastle. The accommodation and all appliances on board the vessel have been specially arranged to give the utmost comfort and facilities for the trade in which she is to be engaged. On leaving the ways the ceremony of naming the steamer *Lackawanna* was performed by Mrs. Frank E. Bliss. The dimensions of the *Lackawanna* are as follows:—Length, 345 ft.; breadth, 44 ft.; depth moulded to spar deck, 31 ft. 6 in.; gross tonnage, about 4,000 tons; and classed 100 A1 in Lloyd's registry. The construction of the *Lackawanna* has been under the direct superintendence of Mr. Blair, chief superintendent, and Mr. McEwan, local surveyor, acting for the Anglo-American Oil Co. Immediately after the launch the *Lackawanna* was towed under the builder's 60-ton derrick crane at their wet dock to receive her machinery and boilers. This machinery consists of a set of triple-expansion single-screw engines, having cylinders 27 in., 43½ in., 70 in. diameter by 51 in. stroke, fitted with Brown's patent steam and hydraulic starting gear, &c. There are two large double-ended boilers, constructed for a working pressure

of 160 lbs. per square inch. The engine-room auxiliary machinery includes Worthington feed and ballast pumping engines, Holmes' electric light engine and dynamo, Weiss' surface feed heater, Morison's evaporator, Dunlop's patent steam and pneumatic marine engine governor. The oil pumping engines, 14 in. by 14 in. by 12 in., consist of two Snow duplex pumps placed in a pump room amidships. These pumps are capable of a combined maximum output of 1,000 tons per hour. In the same pump room is placed a Snow pump, size 8 in. by 7 in. by 10 in., arranged to fill and empty the wells and forward ballast tanks. In the boiler casing there is placed a large donkey boiler, capable of supplying steam to all oil and water ballast pumping engines, feed pumping donkey, electric light, and cargo winches at the same time. The pumping machinery of this vessel is a special feature, everything being designed and fitted to allow of the oil being discharged and water ballast taken on board in as short a space of time as possible.

Bahaduri.—On Saturday, October 28th, the s.s. *Bahaduri* was launched from the yard of the Ailsa Shipbuilding Co., Troon. She has been built for the Indian coasting passenger and cargo trade of Messrs. Shepherd & Co., Bombay, to the order of Messrs. Dunsmuir & Jackson, engineers, Govan, who will supply her machinery. Her dimensions are as follows:—Length over all, 255 ft.; breadth, moulded, 36 ft.; depth, moulded to spar deck, 22 ft. 6 in., and she will carry 1,900 tons deadweight. She has teak decks, steel life-boats, six hydraulic cranes, a complete installation of electric light, and is subdivided into water-tight compartments with instantaneous closing-doors to suit the Admiralty requirements. The machinery will consist of a set of triple-expansion engines, having cylinders 20 in., 33 in., and 55 in. by 36 in. stroke, two double-ended boilers fitted with brass tubes, and working at a pressure of 200 lbs., Weir's feed pumps, feed heater, and evaporator, &c., &c. The propeller has blades of Stone's bronze. The vessel was christened by the Duchess of Portland.

Prome.—On October 30th Messrs. William Denny & Brothers, Dumbarton, launched the steel screw steamer *Prome*, to the order of the British and Burmese Steam Navigation Co., for whose Liverpool, Glasgow and Rangoon trade she is intended. Her dimensions are 345 ft. by 44 ft. by 30 ft., and she is to carry 12 first-class passengers. When fully loaded and at sea she will steam about 11 knots. The christening ceremony was performed by Miss Mackerrow, daughter of the secretary of the company. The vessel goes on the berth, and sails for Rangoon in December

Chelmsford.—On November 7th the Fairfield Shipbuilding and Engineering Co, Limited, launched from their yard at Govan, the *Chelmsford*, a handsome sailing vessel, similar in every respect to the *Chiltonford* launched some time ago by the same company. The dimensions are :—Between perpendiculars, 298 ft.; beam, 44 ft.; depth of hold, 24 ft. 6 in. The masts and spars are of steel. A steel deckhouse amidships contains the galley, petty officers' quarters, carpenter's shop, and donkey-boiler, with condenser and winch. There is also a steam winch at the fore-hatch, and the winches have large whipping drums on ends to facilitate the rapid discharge of cargo. The pumps and windlass are worked by steam from the winches by messenger chains. The *Chelmsford* is 2,350 tons gross, and carries for her net register 1·80 tons, or a deadweight of almost 4,000 tons. Mrs. John Neilson, of Woodside Crescent, Glasgow, gracefully performed the launching ceremony. Amongst those present were Mr. and Mrs. John Neilson, Mr. and Mrs. Joseph Beardmore, Mr. and Mrs. Beattie, and Mr. Richard Barnwell, managing director of the Fairfield Co.

Glen Park.—On November 8th Messrs. Scott & Co., Greenock, launched a steel screw steamer, called the *Glen Park*, for Messrs. J. & J. Denholm, Greenock. Dimensions:—Length, 212 ft.; breadth, 31 ft.; depth moulded, 14 ft. 10 in.; and with a deadweight carrying capacity of 1,250 tons. The builders will supply triple-expansion engines of 800 I.H.P. The *Glen Park*, which is classed 100 A1 at Lloyd's, is a sister ship to the *Well Park*, launched in September. She has been specially designed for the sugar trade. At the launch one of the owners stated that probably there would be another to build.

Lamorna.—On November 9th there was launched from the shipbuilding yard of Messrs. Barclay, Curle & Co., Limited, Whiteinch, a handsome steel three-masted sailing ship, built to the order of Messrs. C. Gordon Cowan & Co., Greenock. The vessel, which has been built under Lloyd's special survey for the highest class, will have a full East Indian outfit, and has been fitted throughout with the most recent appliances for the efficient working of the ship and cargo. Her dimensions are 284 ft. by 42 ft., by 24·5 ft. She measures about 2,340 tons gross, and will carry about 3,900 tons deadweight. On leaving the ways she was gracefully named *Lamorna* by Miss Shankland, daughter of the late Provost Shankland, Greenock.

Canada.—On November 9th Messrs. S. M'Knight & Co launched from their yard at Ayr, a steel screw tug of about 160 tons gross measurement, named *Canada*, for the Alexandra Towing Co., Limited, Liverpool. Her dimensions are:—Length, 92 ft.; breadth, 20 ft.; depth, 12 ft.; built of steel under special survey to class 100 A1 at Lloyd's. Machinery by Messrs. Muir & Houston, engineers, Glasgow. Compound surface condensing engines, cylinders, 21 in., and 42 in. diameter by 27 in. stroke, boiler 14 ft. diameter by 10 ft. long, 100 lbs. working pressure. The construction of both hull and machinery has been carried on under the superintendence of Mr. H. Roscoe, Water Street, Liverpool. The *Canada* is the fourth steamer Messrs. M'Knight have built for the Alexandra Towing Co.

John Williams.—On Saturday, November 11th, Messrs. Robert Napier & Sons, Govan, launched the *John Williams*, an auxiliary screw steamer of about 700 tons, built for the London Missionary Society's South Sea Mission. The vessel has been specially designed by Mr. Gilbert Goodwin, Liverpool, for the work of visiting the various islands in the South Pacific, where the Society has European or native teachers—a service which has been maintained by the Society's sailing-vessels for nearly a hundred years. To get the most economical results possible on the long voyage of 18,000 miles she will be rigged as a barquentine, with about 12,500 square feet of canvas, and have a Bevis feathering propeller for use when the motive power is steam. The dimensions are:—Length over all, 204 ft., and on the water line, 180 ft.; breadth, extreme, 31 ft. 8 in.; depth, moulded, 16 ft. She is built of steel to the highest class at Lloyd's, and has a cellular double bottom for 130 tons of water ballast. The bow is a graceful clipper one with a figurehead, and with the three pole masts and smart rig gives the little ship quite a yacht-like appearance. The cabins, which have been specially arranged for service in a tropical climate, are on the main deck amidships. There is a dining saloon and six state rooms, with accommodation for 12 European missionaries. Further aft there are rooms for the officers and engineers; on the 'tween decks forward 16 double-berthed cabins and a saloon for native teachers; and aft, on the same deck, the quarters of the seamen and firemen. The machinery consists of a set of triple-expansion engines, with cylinders of 15 in., 24 in., and 39 in. diameter, and a stroke of 27 in.; and a single-ended boiler, 14 ft. 3 in. in diameter by 10 ft. 3 in. in length. The working pressure is 175 lbs. to the square inch. There is a complete installation of electric light on board, and everything that can possibly in any way add to the efficiency of the ship. In the *John Williams* the qualities of a fine steamer and a fast sailing ship are combined, and the society is to be congratulated on the latest addition to its unique fleet. The unfavourable weather notwithstanding, there was a large gathering at the launch. In the reserved enclosure were the Lord Provost of Glasgow and Mrs. Bell, the Provost of Govan, and many prominent ladies and gentlemen interested in the operations of the society; and on and around a spacious platform to the west of the ways were hundreds of Sabbath school children and members of the Boys' Brigade. The yard itself was thronged by a very large crowd of people, attracted evidently by more than the novelty of the proceedings. After prayer by the Rev. Mr. Cowe, Mrs. Bell performed the launching ceremony. Severing the cords which held the triggers, she dashed a bottle of water against the bow of the boat, saying as she did so—"I christen you the *John Williams*, in memory of the Christian martyr of Erromanga." The launch was a most successful one, and the vessel entered the water amidst loud cheers, chiefly contributed by those whom Mr. James Hamilton subsequently described as "the small shipowners."

Clan Graham.—On November 15th Messrs. Russell & Co launched on the Clyde the four-masted steel sailing ship *Clan Graham*, of 2,050 tons register and a carrying capacity of 3,450 tons. This vessel has been built to the order of Thomas Dunlop & Sons, Glasgow, and is of the following dimensions:—283 ft. by 40 ft. 6 in., by 24 ft. 6 in.

Seafield.—On November 22nd Messrs. Russell & Co. launched from Kingston Yard, Port-Glasgow, a three-masted sailing barque

of 1,500 tons register, to carry about 2,700 tons deadweight. Length, 245 ft.; width, 37 ft. 6 in.; depth, 22 ft. 6 in. This vessel is built to the order of Mr. J. Archie Russell, Waterloo Street, Glasgow, and has been superintended during construction by Captain James Fairlie, of Glasgow. The ceremony of naming the vessel *Seafield* was gracefully performed by Mrs. Russell. The vessel, which is registered in Port-Glasgow, will fit out in the James Watt Dock, and will also load there for the River Plate.

Doon Glen and Turtle.—On November 23rd Messrs. J. M'Arthur & Co. launched from their yard at Paisley two fine new steamers, named the *Doon Glen* and *Turtle*, which have been built to the order of Messrs. John G. Frew & Co., Paterson Street, Glasgow, and Messrs. Paton & Hendry, Oswald Street, Glasgow. Both steamers are of same dimensions, and are in every respect similar. They are fitted with all the latest and best appliances for handling vessel and working cargo, and are in every way thoroughly equipped for the coasting trade, in which they will be employed. Powerful compound surface-condensing engines are now being fitted to each of the steamers by Messrs. Bow, M'Lachlan & Co., Paisley, and in course of a few days both vessels will be fully completed and handed over to owners. After the launch, the owners, builders and a number of friends adjourned to the moulding loft, where the customary toasts were proposed and responded to. Amongst those present were ex-Provost Wilson, Greenock; Mr. J. M. Paton, and Mr. P. D. Hendry, Glasgow; Bailie Frew, Govan; Mr. Dunn, Singapore, &c., &c. The *Doon Glen* was named by Mrs. Jas. Frew, wife of Bailie Frew, Govan, and the *Turtle* by Miss Isa Martin, Shawlands.

Malleco.—On November 23rd Messrs. R. Napier & Sons launched from their shipyard at Govan the second of two steel twin-screw steamers they are building for the Compania Sud Americana Vapores of Valparaiso. The vessel has been built to the instruction of Mr. Thomas Dewsbury, Leeds, and has been specially designed to meet the requirements of the company's Pacific coasting trade, being intended to carry a large cargo on a light draught of water, while comfortable accommodation has been provided amidships for the passengers. The principal dimensions are:—Length, 170 ft.; breadth, 32 ft.; depth to awning deck, 17 ft. 6 in.; tonnage, about 750 tons. The machinery, which has been constructed at the builders' Lancefield works, consists of two sets of triple-expansion engines and a single-ended steel boiler for a working pressure of 150 lbs., with all the most modern improvements to attain efficiency and economy. The ship was named the *Malleco* by Miss Dewsbury. After a uccessful launch the vessel was towed up the harbour to receive shor machinery.

Erin-go-Braugh.—On November 23rd Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley, launched from their yard a steel screw hopper dredger for the Limerick Harbour Commissioners, Limerick. She has been constructed for carrying out extensive improvements in the channel of the River Shannon. The dimensions of the vessel are 150 ft., by 32 ft., by 13 ft. 7 in., and she is capable of raising 300 tons per hour from a depth of 35 ft., and has a hopper carrying capacity of 400 tons. The main engines are of the builders' improved triple-expansion type to indicate 500 H.P. The dredger and all her machinery have been constructed under survey of the British Corporation for the Registry of Shipping, and built to their highest class. The vessel throughout is fitted with the builders' most improved appliances for hopper dredgers. As she left the ways she was named *Erin-go-Braugh* by Miss Mary Fleming, Elmhurst, Langbank, daughter of one of the builders.

Kanawha.—On November 24th the last of three large cattle steamers, built by Messrs. Alex. Stephen, & Sons for the Chesapeake and Ohio Steamship Co., Limited, of London, was launched at Linthouse. These vessels have already been fully described. The dimensions are 370 ft., by 44 ft., by 31½ ft., the gross tonnage about 4,000 tons, and the cylinders 28 in., 46 in., and 75 in. diameter by 54 in. stroke. The vessels are all built in excess of the requirements for the highest class in Lloyd's, and besides large measurement for deadweight cargoes, each ship has very special and superior arrangements for carrying 760 live cattle. The new ship was gracefully named the *Kanawha* by Mrs. Glynn, wife of John Glynn, Esq., Liverpool, who mentioned that the record in the cattle trade between Newport News and this country was at present held by the sister ship *Shenandoah*, and he hoped that one of the three would hold it till the record was broken by another ship by the same builders for the same owners. The *Kanawha* will take her place early this month in this service, under command of Captain Maxwell.

LAUNCH—Irish.

Templemore.—On November 9th Messrs. Harland & Wolff launched the *Templemore*, a large screw steamer, from the south end of the Queen's Island. The vessel of which Messrs. Wm. Johnston & Co., Limited, of Liverpool, are the owners, and which is intended for the North Atlantic trade, is built to the highest class at Lloyd's, as well as the British Corporation Register, and will have a gross tonnage of 6,100. An awning deck fore and aft will be fitted for cattle, which will also be carried on after part of the upper deck. The *Templemore* will have four steel pole masts, a derrick being attached to each, and seven hatches with winches, which will enable cargo to be dealt with rapidly. In the wheelhouse aft is fitted Wilson & Pirrie's patent combined steam and hand steering gear, with spring quadrant to tiller. The captain's house is on the boat deck, and quarters for the officers, engineers, and foremen are provided in bridge-house amidships; those for petty officers are on upper deck aft; while the cattlemen, seamen, and firemen's are on the same deck forward. The electric light will be fitted throughout the vessel. The triple-expansion engines for the ship, which will have an I.H.P. of 3,500, have also been constructed by the builders. Mr. William Johnston, the senior member of the owners' firm; Captain Johnston, their marine superintendent; and Mr. Garrick, their superintendent engineer, were present at the launch.

LAUNCH—American.

United States Battleship "Oregon."—On October 27th there was launched at San Francisco the *Oregon*, a sea-going coast line battleship, and the most powerful ship in the United States Navy. Her dimensions are:—Length, over all, 348 ft.; water-line, 320 ft.; breadth, 60 ft. 8 in.; draught, 24 ft.; displacement, 1,039, and has maximum H.P. 8,000. She will have a maximum speed of 16·210 knots, and will carry a crew of 460 men. The cost, inclusive of armament, is 4,000,000 dols. She will carry four 15 in., four 8 in., and four 6 in. breech-loading rifles, sixteen 6-pounder, and six 1-pounder rapid-firing guns, and two Gatlings, besides twelve torpedoes, seven above water. And almost the heaviest battery carried by any foreign cruisers is that of the Russian Fleet, which carries two 12 in., four 5 in. and 4 in., ten 3-pounders, four machine guns, and six torpedo tubes. The vessel has a belt of steel from 3 ft. above the top of water-line to 4½ ft. below it, extending 196 ft. amidships to protect the engines and boilers. Above this is another belt 5 in. thick. The turrets of the heavy guns are built of steel 17 in. thick.

LAUNCH—Norway.

Colombia.—On November 11th there was launched from the yard of the Bergens Mekaniske Værksted, Bergen, a steel screw steamer of the following dimensions:—Length, over all, 216 ft. 6 in.: breadth, moulded, 29 ft.; depth, moulded, 14 ft. 4½ in. She is built to the highest class in "The Norwegian Veritas," and has raised quarterdeck aft, bridge amidship, and topgallant forecastle. Cellular double bottom for waterballast in main and afterholds, and peat tanks fore and aft, steam windlass, three large steam winches, steam steering gear, &c. Every modern improvement has been embodied in her construction and outfit. She is specially built for the American fruit trade, and has a large number of ventilators to the holds as well as heating apparatus for the trade in winter. In a large deckhouse aft is fitted comfortable cabins for twelve passengers, as well as saloon, &c. Her engines are triple-compound, with cylinders 16½ in., 26½ in., and 43 in. diameter and 30 in. stroke, I.H.P. about 700, extra large steel boilers constructed for a pressure of 175 lbs. per square inch. Speed, fruit laden, 11½ knots. When she left the ways she was named *Colombia*. She is built to the order of Adolph Halvorsen, Esq., of Bergen.

The Bute Docks.—The Bute Docks Co. contemplates the construction of a dock on land reclaimed by the formation of embankments. The proposed dock will commence opposite the south-western corner of the Roath dock, and will extend in a south-westerly direction for a distance of 857 yards. An entrance lock 850 ft. in length is contemplated.

TRIAL TRIPS.

Pfalz.—On Saturday, October 21st, the steamer *Pfalz*, built and engined by Messrs. Wigham Richardson & Co., Neptune Works, Newcastle-on-Tyne, went for a highly successful trial trip off the coast. The *Pfalz* has been built to the order of, and is the latest addition to, the magnificent fleet of the Norddeutscher Lloyd of Bremen, and will run in their passenger service between Bremen and the River Plate, carrying first-class passengers, emigrants, and cargo. She is a fine steel-screw steamer, 376 ft. in length by 43½ ft. beam, and has been fitted with powerful engines and boilers, which on the trial trip drove her at a speed of 13¼ knots per hour, a highly satisfactory result. She has all the most modern improvements for the safety and speedy working of the ship, and for quickly loading and discharging her cargo. The accommodation for the first-class passengers is of the most comfortable and elegant description, comprising a large dining saloon, entrance hall, smoking-room, and ladies' room, together with the usual state-rooms, baths, and lavatories, &c. The dining saloon is a handsome apartment, fitted up in light oak, and upholstered in green Italian haircloth. Other apartments are also upholstered in this material, which is specially suited for the climates in which the vessel will run. The ladies' room is tastefully fitted and decorated, and the smoking-room is a large and airy room in polished teak. The state-rooms are fitted with spring beds, and have every convenience. including wardrobe and two patent washstands in each room. The sanitary arrangements are of the best, and the baths are provided with water heating apparatus. Electric lighting is fitted throughout, the current being supplied by two engines and dynamos placed in the engine-room. A refrigerating engine is fitted in connection with the provision room. Large steam and other gallies, bakeries, steam coffee mills, steam heating, &c., help to show how thoroughly the comfort and convenience of passengers and emigrants alike are studied in vessels belonging to the Norddeutscher Lloyd fleet. On the trial trip the engines worked without the slightest hitch, giving entire satisfaction to all present, amongst whom were Dr. Wiegand and Mr. Leist, representing the owners; Mr. John Tweedy and Mr. J. Denham Christie, of the builders' firm; and Captain Bruns and Mr. Heine, under whose superintendence the vessel has been completed. Immediately after the trial trip the steamer left for Bremen under the command of Captain Winter, and she will at once be put on her regular service. The engines in this vessel are a duplicate of a set also building by Messrs. Wigham Richardson & Co. for the same company's new steamer *Mark*, which vessel was launched a few weeks ago from the yard of Sir W. G. Armstrong, Mitchell & Co.

Germania.—The steam fishing vessel *Germania*, the latest addition to the Grimsby fleet of trawlers, has lately been on her trial trip. She is the first of four vessels which are being built to the order of the International Steam Trawling Co., of Grimsby, and Messrs. C. D. Holmes & Co., with whom the contract was placed, have fitted into her triple-expansion engines of 45 N.H.P., large boiler, and their special winch, all of the latest and most improved type, the hull being built by Messrs. Cochrane & Cooper, of Beverley. The *Germania* left Minerva Pier at nine o'clock, and steamed up the Humber to Grimsby, where a large party of those interested in the firm were taken on board; she then proceeded out to sea, where the vessel's sea-going qualities and speed were tested, the result showing 10¼ knots. During the whole of the trial the machinery worked without the slightest hitch, and to the entire satisfaction of the owners' representatives. The company on board included Captain Taylor, manager; and Mr. W. J. Wood, superintendent engineer to the company; also Mr. Cochrane and Mr. J. R. Smith, representing the shipbuilders and contractors respectively.

Cardiff.—On Wednesday, October 25th, the handsomely modelled steel screw tug, *Cardiff*, built by Messrs. E. Finch & Co., of Bridge Works, Chepstow, to the order of The Brazilian Coal Co., Limited, Cardiff, for their Rio de Janeiro Depôt, ran a very successful trial trip in the Bristol Channel. She is No. 162 in the builders' books, and is the second tug-boat built by Messrs. Finch & Co. for this firm. Her principal dimensions are:—Length, between perpendiculars, 90 ft.; breadth, 17 ft. 3 in.; depth, top of keel to top of beam, 9 ft. 7 in. She has been built under Lloyd's special survey for the 100 A1 class for tug purposes, and has accommodation for captain and engineer aft, and for crew forward. She is fitted with compound surface condensing engines 16 in. by 30 in. by 22 in. stroke, made by the builders, boiler 10 ft. diameter by 9 ft. 9 in. long, with two furnaces 3 ft. internal diameter, with a working pressure of 100 lbs. per square inch.

Maori.—On Saturday afternoon, October 28th, the *Maori*, a large and beautifully modelled steel screw steamer built by Messrs. C. S. Swan & Hunter, Wallsend, to the order of Messrs. the Shaw, Savill and Albion Co., Limited, London, left the Tyne on her trial trip on the measured course off Tynemouth. The builders were represented by Mr. Hunter, the engine builders by Mr. Mudd, of the Central Marine Engine Works, West Hartlepool, and the owners by Captain McKirdy and Mr. Young, engineer superintendent, the vessel being under the command of Captain Scotland. The *Maori* has been specially designed and fitted out for the Colonial frozen meat trade, the whole of the latest improvements having been introduced in her deck machinery and cargo stowage. She is built on the improved three deck type, with poop, long bridge house, and long topgallant forecastle. Water ballast is adequately provided on the cellular double bottom principle throughout. Her deck machinery includes eight powerful steam winches. The engines are 29 in., 46 in., and 77 in., with a stroke of 48 in., the dimensions of the steamer being 415 ft. over all, 48 ft. in breadth, with a moulded depth of 32 ft. 6 in. The holds and 'tween decks of the vessel are insulated, and the refrigerating machinery has been supplied by the Haslam Foundry & Engineering Co., Limited, Derby. After the trial trip, which proved most satisfactory, a mean speed of 12 knots being attained on a succession of runs, the stately craft proceeded to London to ship a cargo for her maiden voyage.

Chickahominy.—On Saturday, November 4th, this fine vessel went on her trial trip off the Hartlepool coast prior to making her maiden voyage across the Atlantic. She is the second of a group of three steamers built at the Middleton Shipyard, West Hartlepool, by Messrs. Furness, Withy & Co., Limited, for the Chesapeake & Ohio Steamship Co., and is fit not only for general cargo, but especially for the carriage of live cattle from the United States to this country. The *Chickahominy* is a very large steamer, and contains many specialities in her construction, which have been introduced by the builders to suit the Atlantic trade and to facilitate the manipulation of cargo. Strength in the general construction of the structure without excessive weight of material has been pointedly kept in view, the disposition of the material being planned as far as possible on scientific methods and with a view to resist the exceptional stresses brought to bear upon an Atlantic trader. Two whole decks almost from stem to stern are given up to the accommodation of live cattle, and numerous improvements are provided for their safety and comparative comfort whilst on the voyage, the arrangements for ventilation and for the rapid supply of fresh water deserving especial mention. The vessel is provided with main engines and boilers from the Central Marine Engine Works, West Hartlepool, the cylinders being 28 in., 43½ in., 73 in., by 48 in. The boilers are two large double ended boilers, working at 160 lbs. per square inch, made on the plan universally adopted at the Central Engine Works with welded and flanged shell plates. The engines are of the well-known open-fronted type produced at these works, and on the trial trip they were handled ahead and astern with the greatest possible facility. Mudd's patent evaporator and tail shaft preserver and other specialities are provided so that the engine department is thoroughly abreast of the times in all its accessories. The vessel is fitted throughout with a most complete arrangement of electric lighting, supplied by Messrs. Clarke, Chapman & Co., of Gateshead. The trial trip took place on a most unfavourable day, there being a heavy sea running and much wind, which prevented anything like a test being made of the speed of the vessel. The engines, however, ran in a highly satisfactory manner and to the entire approval of those on board. The owners were represented by Captain Manley, the ship superintendent, and Mr. George Macfarlane, of Glasgow, who has superintended the construction of the machinery; the builders by Mr. Greenhow and Mr. Mills; and the engineers by Mr. Baines and Mr. Mudd. An excellent luncheon was provided on board, during which expressions of entire satisfaction with the work both in the ship and engine department were given by the representatives of the owners, and the party having disembarked and proceeded to the tug-boat by means of a small coble, the vessel headed her way to the North and proceeded to pass round the coast of Scotland to the Atlantic Ocean for her first trip to the States.

Ormiston.—On November 24th the new screw-steamer *Ormiston*, the second vessel built for Messrs. R. & C. Allan by Messrs. Workman, Clark & Co., Limited, Belfast, proceeded down Belfast Lough on her trial trip. The dimensions are:—Length, 361 ft.; breadth, 44 ft. 3 in.; depth, moulded, 29 ft.; gross tonnage, 3,560; and carrying capacity, 5,600 tons. She is built to Lloyd's highest class three-deck rule, and to the B.S. class of the British Corporation. The arrangements for loading and discharging cargo and navigating the ship are of the most approved type. A complete installation of electric lighting is introduced into the rooms, holds, and machinery spaces. The machinery consists of triple-expansion engines of the modern type, and steam is supplied at a working pressure of 180 lbs. from two large boilers. These are fitted with forced draught by James Howden & Co. The machinery was constructed at Messrs. Workman, Clark & Co.'s engine works, Queen's Road. An average speed of 13 knots was attained on running the measured mile. The *Ormiston* will proceed to Cardiff to load for Singapore.

Eskdale.—On November 24th the trial trip of the screw-steamer *Eskdale* took place down the river from Greenock, when a speed of 11½ knots was attained on the measured mile. The steamer was built by Messrs. Charles Connell & Co., Whiteinch, and engined by Messrs. David Rowan & Son, Glasgow, to the order of Messrs. Robert M'Kill & Son, and is intended for the Eastern trade. The vessel is 320 ft. by 42 ft. by 23 ft. 8 in.; has a cargo-carrying capacity of 4,550 tons, and has a hold measurement of about 5,750 tons. Her engines are triple expansion, 23 in., 37 in., and 61 in., and 42 in. stroke, and there are two large single-ended boilers of 160 lbs. working pressure. The *Eskdale* is fitted with all the latest appliances for the rapid loading and discharge of cargo. Her trial trip was in every way satisfactory alike to builders, engineers, and owners.

Corso.—On November 24th the Campbeltown Shipbuilding Co.'s steamer *Corso*, of 772 tons nett register and 1,950 tons deadweight, recently launched from their yard at Campbeltown (Clyde), made her trial trip, when an average speed of 11¾ knots was attained. The *Corso* is a steel screw steamer of the part awning deck type, designed to carry 1,950 tons deadweight on 16 ft. 7 in. draught, and has been supplied with a set of triple-expansion engines by Messrs. Kincaid & Co., Limited. Engineers, Greenock, constructed under the immediate superintendence of Mr. Thomas Broom, consulting engineer, Greenock. All the latest improvements for navigating the ship and for the speedy loading and discharging of cargo, have been supplied. A large party was on board, including Captain Rich, who is to take command of the vessel, and Mr. G. H. Wills, representing the owners, Messrs. G. H. Wills & Co., Cardiff. The usual toasts were proposed and responded to, much satisfaction being expressed with the vessel by the respresentatives of the owners present. The *Corso* is intended to trade on the West Coast of Africa.

Rothenfels.—On November 25th the s.s. *Rothenfels* left the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesbrough, for her official trial trip, which consisted of a series of runs along the East Coast. During the trials everything worked to the satisfaction of all on board, and the vessel afterwards returned to Middlesbrough Dock, in order to complete coaling. She has been built to the order of the Hansa Steamship Co., of Bremen, and is the second steamer completed this year for this company by the same builders, and they are now fitting out a sister ship to the *Rothenfels*. The principal dimensions are:—Length, 327 ft.; beam, 41 ft. 9 in.; depth, moulded, 28 ft. 6 in., with engines by Messrs. Thomas Richardson & Sons, of Hartlepool, having cylinders 24 in., 38 in. and 64 in. by 42 in. stroke, with two large steel boilers working at 160 lbs. pressure. The vessel is of the spar deck type, and takes Lloyd's highest class. The spar deck is of steel, sheathed with teak. The main deck is of steel. The poop, bridge and forecastle decks are of teak. Throughout the holds web frames are fitted in lieu of hold beams, and the steamer has a carrying capacity of about 4,500 tons. Handsome accommodation is provided for the captain, officers, engineers, and a few passengers. The fitting out of the steamer has been carried out under the superintendence of Captain Lange, who will take command.

The Naval Armaments and Construction Co. have secured the order from the Admiralty to build the engines, boilers, &c., for the first-class line of battle ship *Majestic*, which is to be built at the Pembroke Dockyard. These engines will develop an I.H.P. of 12,000.

Reviews.

Theory and Practice of Navigation. By William H. Barham, Lieut. R.N.R. London: William Collins, Sons & Co., Limited.

This is a recent addition to Collins' Elementary Science series. So we learn from the preface, which is dated August, 1893, for curiously enough, the title page bears no date. Sixty illustrations, one hundred and sixty pages of text, and an index are afforded to the student, for what surely one of Dickens' characters described as the "ridiculous sum, sir, of eighteen pence."

A great number of problems in elementary navigation are explained and worked out, and the work of a deck officer is, as far as his navigating duties are concerned, clearly indicated. Of course, into the space it is impossible to squeeze an exhaustive treatise and an explanation of all the theories which are the basis upon which the superstructure of rules are built. But the reader will be astonished to find how with diagrams and definitions and rules lucid explanation is afforded in very limited space. The book is certain to be of use to the student. And we shall look forward to seeing Lieut. Barham's further contributions to the rapidly-increasing series of scientific books.

A Manual of Telephony. By W. H. Preece, F.R.S., and A. J. Stubbs. London; Whittaker & Co., 1893.

This is, as the names of the authors alone would prove, a most valuable contribution to this very valuable series. After a very slight sketch of the history of this marvellous invention, the subject of induction is attacked. Some interesting experiments in relation to the extreme sensitiveness of the appliance are given. From one of these, conducted by Mr. Preece, it was determined that a Bell receiver will respond to a current whose force is no more than six ten-thousand millionths of a milliamphere. Then the evolution of the microphone and the various types of receivers and transmitters are dealt with. Their name is legion.

The chapter on telephonic research is most interesting and the fact of Reis' discoveries having undoubtedly preceded Bell's by sixteen years, affords occasion for the remark that it is one thing to discover a principle and quite another thing to make it commercially useful. This statement is one which should be engraved in large letters over the doors of the patent-office—a building that, while a veritable Tom Tiddler's ground to an occasional inventor, is more often the grave of his hopes. It is the old experience, the many fail the few succeed.

The next point to which attention is called is the apparatus used in the exchange, viz., the switch-board and its kindred appliances, and here again we see what an enormous amount of research and ingenuity have been bestowed on the development of the telephone. The account of the systems adopted by the National Telephone Co., by the Post Office, and by members of the Stock Exchange, in communicating with their own offices, shows how the apparatus must be adapted to the particular requirements of every case. The utilisation of telegraph wires for telephonic purposes is one which is naturally most desirable, but after a considerable discussion the conclusion is arrived at that it is not possible in this country, as it would be dearly bought at the necessary price, the impairing of the efficiency of the existing system. The telephone as an aid for military purposes is discussed, and Sloper's ingenious system for secret communication explained. Then the manufacture of wires and cables is dealt with, and the volume, which is throughout well illustrated, closes with some useful tables in an appendix. The book will not only be of great use to the practical telephonist, but it will also serve to show the "general scientific reader" how much has been done in this department during the first sixteen years of its existence as a commercially useful science.

Walter's Marine Glue.—Mr. Thos. Beynon, the agent for Newcastle and district for the sale of Walters' Marine Glue, has received from local shipbuilders and others some heavy orders for this speciality lately, a considerable number of which are *repeat* orders. This speaks volumes for the appreciation in which the article is held, and there is no doubt that when its merits become more widely known, the sales will be largely increased.

Fractured Thrust Shaft, s.s. "Olive Branch." (See page 404.)

Correspondence.

It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—ED. M. E.]

S.S. "OLIVE BRANCH."

To the Editor of THE MARINE ENGINEER.

DEAR SIR,—As per my promise when you were in Cardiff at the meeting of Naval Architects, I have pleasure in sending you photographs of a thrust shaft, which was fractured at sea, and successfully repaired by the chief engineer, Mr. Andrew Young, which I consider very creditable, when we take into consideration the tools and appliances which the chief engineer had.

The particulars are as follows:—The above steamer left Barry on October 6th, 1892, bound for Cape-de-Verdes; she experienced very heavy weather up to the 11th, during which time the engines raced very heavily. The shaft broke at 6.55 p.m., on that date, without giving any warning. The fracture took place on the after side of the forward collar, close to the fillet. The chief engineer, together with his staff, set about to repair it at once, and after working on it until 8 p.m., of the 17th, they decided to try the engines, and at 9.15 the engines were put slow speed, and gradually increased to half speed, or thirty-five revolutions per minute. As the weather was very unfavourable to proceed to Cape-de-Verdes, the Captain decided to head the vessel for Gibraltar, at which port she arrived safely on October 20th, without any further mishap.

Upon looking at the photographs you will see that the chief engineer had the shaft set together and drilled three holes, into which he inserted three iron studs. On the forward collars he cut keyways, and dovetailed three longitudinal pieces of iron into these recesses, these were further secured by a clamp. The diameter of the shaft was, $11\frac{3}{4}$ in., diameter of collars, $18\frac{1}{2}$ in.

By repairing it in this manner, it enabled him to make use of two of the three collars; had bolts been used, one collar only could have been used.

I think great credit is due to Mr. Young and his staff, for the manner in which they did the repairs, especially under the circumstances, with no tools or appliances, and during a heavy gale.

Yours truly,
J. H. HALLETT.

Bute Docks, Cardiff.
November, 14th, 1893.

PHOSPHOR BRONZE, DELTA BRONZE, AND GUN-METAL.

To the Editor of THE MARINE ENGINEER.

DEAR SIR,—As a sea-going engineer, there are a few questions I should like some of your subscribers, or the makers of propeller blades of any of the above class of metals, to answer.

1st. What gain in speed is there with these metals against cast-iron?

2nd. What amount of pitting takes place on the stern post and other parts of the after end?

3rd. If this pitting takes place, is it necessary to dock the ship oftener?

4th. What are the best preventatives against this pitting?

In all these questions I am referring only to *cargo boats*.

There is plenty of scope for a good discussion on the above; we hear a great deal about propellers of these metals on Mail steamers, and other high speed ships, but the tramp steamer seems to be quite ignored.

I remain,
Yours truly,
J. C. STEPHENS.

Rotterdam, Holland.
October 31st, 1893.

TWIN SCREWS.

To the Editor of THE MARINE ENGINEER.

DEAR SIR,—Could you or any of your readers kindly give me any information respecting the correct direction in which the screws of twin screw passenger steamers should run? I may mention that the engines of the steamers with which I am concerned can be run in either way, as the guides are equally good on either side.

Thanking you in anticipation, I am, yours very truly,
J. B.

Bergen, *November 13th*, 1893.

ADVANTAGES OF FLANGED WORK.

To the Editor of THE MARINE ENGINEER.

SIR,—Being rather interested in your remarks on the advantages of flanged work, particularly in the case of floors, where flanges have superseded the older style of riveted angles, I have taken the liberty of addressing you on the subject, having recently had some experience in dealing with repairs to a vessel where this system had been largely adopted. The vessel I refer to (a new one) had been ashore on an exposed position in the Java sea, and when docked, the bottom was found to be so much damaged that 44 plates, each about 18 ft. long, had to be removed, being either broken or badly bent.

On the removal of the plates the whole of the floor plates were bent and twisted from the bow to the after-part of engine-room under the boiler and engine seats; double reverse angles had been fitted in lieu of flanges, and in many cases the rivets were sheared, while the flanged plates were quite sound at the flanges, and only required to be straightened and afterwards replaced. One feature in our system of framing double bottoms requires to be improved upon, that is in the cutting of manholes in floors. It is the custom to cut these holes larger than there is any need for, presumably to lighten the structure, and consequently the light displacement. But it is time this practice was put a stop to. In the case herein referred to the floor plates were cut away until little or any of the plates remained beyond the vertical flange of frame, the consequence being that the plates collapsed in the way of all manholes. Lloyd's rules are already quite bulky enough, but a rule affecting this matter might profitably be inserted. The common custom of lowering the ends of floor-plates at the fore and after ends of vessels to give a flatter floor inside is another matter that deserves attention, as I have seen more than one case where the bottom had been bodily drawn upwards, giving way just at the point where the floor-plates terminated.

It may be stated that nearly all the floor-plates were straightened with a hydraulic flanger while cold. The only plates condemned being the ones that were fractured in the way of manholes.

I may remark that in straightening the damaged plates while cold, an arrangement was made on the anvil of the flanger so that they were bent a little past the straight as they came back a little on being relieved of the pressure. Hoping these few remarks will not be thought out of place,

I am,
Yours truly,
JAMES SELLAR,
Superintendent New Harbour Dock Co.

Singapore, *Sept. 29th*.

Miscellaneous.

The screw steamer "Emerald," lately purchased by Messrs. Donald & Taylor, of Glasgow, has had her compound engines altered for the use of steam at high pressure. A new high-pressure boiler of extra large dimensions has been fitted, together with an entire set of new mountings and connections. The engines, which were previously of the ordinary compound type, with cylinders 27 in. and 50 in. by 30 in. stroke, working at 65 lbs. pressure, have been reconstructed, the alterations to cylinders making them now 17 in. and 47 in. by 30 in. stroke, with a boiler pressure of 160 lbs. per square inch. The engine work has been effected by Mr. George T. Grey, Holborn Engineering Works, South Shields, the boiler being supplied from Messrs. Jos. T. Eltringham & Co.'s Works, of South Shields, who also carried out the alterations and repairs to the vessel's hull. The owners state that on her first voyage, with a cargo of 1,300 tons, the vessel averaged $8\frac{1}{2}$ knots with 460 I.H.P., and the consumption did not exceed $1\frac{1}{2}$ lb. per I.H.P. per hour.

The Italian Ironclad "Re Umberto."—The *Re Umberto*, one of the largest of the new ironclads of the Royal Italian Government, was taken out on the 25th October for the manufacturers of the machinery, Messrs. Maudslay, Sons & Field, London, for the official trials and for final acceptance of the machinery by the Italian Government. The contractors were represented by Mr. John Sampson, one of their directors. The trials proved of a highly satisfactory character. The contract stipulated for the development of 15,200 H.P. natural draught and 19,500 forced draught, but as hereafter shown the Government decided to abandon the forced draught trials. The run was made from Spezia to Genoa and back, a distance of 120 knots, at an average speed of 18·3 knots, the engines indicating a mean of about 17,000 H.P. with ½ in. of air-pressure in the stokeholds. The *maximum* power during the run was found to be 19,000 H.P., and the *maximum* speed 18¾ knots, which was obtained by only ½ in. of air-pressure. The machinery worked smoothly in every respect, no water service being used. The boilers gave a plentiful supply of steam without priming or other difficulties. The results were considered so satisfactory from every point of view, both as regards the speed of the vessel and the facility with which the speed could be maintained (the trial being made by the ordinary ship's crew and not by special stokers), that the commission appointed recommended the Marine Ministry to accept the machinery without further trials, as it appeared so obvious that the H.P. with forced draught would largely exceed the contract power of 19,500 horses. The recommendation was therefore accepted by the Ministry of Marine. This powerful ironclad is fitted with four 34 cm. 67-ton Armstrong guns; eight 15 cm. guns; 16·12 cm. quick-firing guns; 10 5·7 cm. ditto; and 17 3·7 cm. ditto, and two machine guns. The dimensions of the ship are as follows:—Length, 400 ft.; beam, 76·9 ft.; draught, 28·6 ft.

A Vessel Three Times Sunk.—The *Fernsides*, which arrived at Sunderland on November 15th, has had a very remarkable history, which is probably unique in the annals of shipping. Alderman Shadforth, J.P., has supplied us with the details of her strange vicissitudes. The vessel was formerly known as the *Triumph*, but the chances are that if her then owners could have foreseen her career another and more appropriate name would have been chosen. Her experiences date from early in 1884. In January of that year she was entering Dartmouth Harbour, and striking a rock which was not buoyed, holed herself and sank. She was ultimately raised and repaired, and an action was brought against the Commissioners of Dartmouth Harbour for their negligence, with the result that a verdict was given in favour of the owners as against the commissioners. The revenue of the latter was small, however, and the action was subsequently compromised. In October, 1888, she came into collision with the Spanish steamer *Rivas* in the Tyne, when proceeding to sea, and sank. Salvage operations were entered upon by the Dundee Salvage Co., who lost all their money in the attempt, which proved unsuccessful. Afterwards a Continental salvage company undertook to raise the sunken vessel, and eventually succeeded, it being necessary to build a kind of coffer deck on the well of the ship in order to prevent the tide from sweeping the deck. She was then sold by the underwriters to the present owner, Mr. J. L. Browne, who was at that time her managing owner. At this stage her name was changed to *Fernsides*, by which she has since been known. On the 5th of January this year, in proceeding to Christiana from the Black Sea with a cargo of grain, and when nearing the port in a thick fog and a heavy snowstorm, she struck a rock, and two or three hours later was abandoned, she was supposed to have foundered. However, the vessel drifted up the Tonsbergfjord for a few miles, through a very intricate navigation. The ship cleared the numerous rocks without touching any of them, and at length found a resting-place right up the fjord, where she sank for the third time, the stern, however showing above water. Arrangements were effected with the Svitzer Salvage Co. to raise her. Various efforts to this end were made, but owing to the severe frost and snow which continued from the 18th of January to the early part of March these attempts failed, and it was not until the ice cleared away that salvage operations were resumed. On the 12th of June she was successfully raised and taken to Sandefjord, where she was temporarily repaired by Mr. Warne, of that port, and afterwards proceeded to Sunderland.

Russian Battleship "Admiral Oushakoff."—The new Russian coast battleship *Admiral Oushakoff* was launched from the Baltic Shipbuilding Yard on the Neva, the Czar and Czarina being present on the occasion, with other members of the Imperial family. The new ship, which is named after a distinguished commander of the Russian Black Sea fleet at the end of the last century, was begun in the Baltic works in July of last year, the Emperor and Empress having performed the ceremony of laying down the keel on November 3rd, 1891, the day on which the great cruiser the *Rurik* was launched from the same yard. The dimensions of the *Admiral Oushakoff* are:—Length of hull, 278 ft.; breadth of beam, 52 ft.; draught, 17 ft.; and displacement, 4,126 tons. The greatest thickness of her side armour will be 10 in. Her twin engines and four boilers have been made by Maudslay, Son & Field; the engines are of the triple-expansion type, representing together 5,000 I.H.P., and capable of giving the ironclad a speed of 16 knots. The armament will consist principally of four 10-in. guns placed in two armoured turrets, and 20 quick-firing guns, besides torpedoes. Her normal supply of coal is calculated at 200 tons, although she is considered capable of carrying double that quantity. The *Rurik*, it may be added, is now being fitted out for sea, and it is, to say the least, a remarkable circumstance that the English Navy has not a ship afloat capable of overtaking and capturing this Russian vessel. The *Powerful* and *Terrible* have been designed for that purpose, but so far only one of them has been laid down.

American Shipbuilding Enterprise.—The *N.Y. Journal of Commerce*, says:—When the construction of the new navy began 11 years ago, there was scarcely any yard on the Atlantic coast capable of doing the work except those of Messrs. Roach and Cramp. No yard on the Pacific was in a condition to bid. A St. Louis yard put in a bid for the smallest of the four ships, but at figures much above those of yards on salt water. When the Union Iron Works of San Francisco secured some contracts they were at figures much higher than those of the Cramps. How the shipbuilding business has grown is shown by the fact that when the bids for gunboats 7, 8, and 9 were opened, they were found to come from seven builders, and neither Cramp nor the successor of Roach was represented. Among the bidders were the Maryland Steel Co., and the Newport News Shipbuilding and Dry Dock Co., which have never entered the lists before, and the Colonado Foundry and Machine Co. of California, of which the Navy Department probably never heard before. This last company offered to build gunboat No. 7 for 372,000 dols., the bid of the Maryland Steel Co. of Baltimore being 280,000 dols. that of the Union Iron Works of San Francisco 400,000 dols., and that of the Bath Iron Works, Maine, 425,000 dols. The Newport News Co., put in an extremely low bid for this boat, 290,000dols. There must have been bad calculation somewhere, for the Union Iron Works treated No. 7, as considerably more expensive than 8 or 9, while the Maryland Steel Co. treated all as alike costly, and the Bath and Newport News Co. treated No. 7 as the least expensive of the three.

Second-class Cruiser "Hermione."—The new second-class cruiser *Hermione*, which has been built in Devonport Dockyard, was successfully launched on the afternoon of Nov. 7th, the ceremony being performed in the presence of several thousand persons, by Lady Lyons, wife of Admiral Sir Algernon Lyons, K.C.B., naval commander-in-chief. The *Hermione*, which is one of the vessels built under the Naval Defence Act of 1889, was laid down at Devonport in December, 1891, and was designed by Mr. W. H. White, Assistant Controller and Director of Naval Construction at the Admiralty. Her principal dimensions are:—Length, 320 ft.; breadth, 49 ft. 6 in.; mean load draught, 19 ft. She will be powerfully armed with quick-firing Maxim and Hotchkiss guns of the newest type, and will be fitted in addition with several Whitehead torpedo tubes. Her engines and machinery have been supplied by Messrs. J. & G. Thompson, of Glasgow, and the total cost of the ship when completed, and including her armament, will be £244,625. She is expected to develop 9,000 and 7,000 H.P. respectively, with forced and natural draughts, and to accomplish a speed of 19·5 knots with forced, and 18·25 knots with natural draught. The *Hermione* will be completed, and in all respects ready for sea by November last. Amongst those present at the launch were Admiral Sir Algernon Lyons, K.C.B., Rear-Admiral Sir R. H. More Molyneux, K.C.B., Admiral Superintendent of the dockyard, Admiral Sir George Watson, K.C.B., and Sir Massey Lopes.

Swiftest Warship Afloat.—The new commerce destroyer *Colombia* was sent on a preliminary trial spin over the Government course from Cape Ann (Mass.) to Cape Porpoise (Me.) on 14th November. Under forced draught she developed a speed of 22·87 knots per hour, and under natural draught 20·2. This

means that at the official trial which takes place next Tuesday she will easily make 23 knots, and earn a premium for her builders, Cramp & Co., Philadelphia, of close upon 400,000 dols. The length of the course is 43·97 knots, and it was covered in 3 hours 18 minutes, which includes 21 minutes expended in making the trip at the eastern end of the line. It is the fastest time ever made by an American ship-of-war, and when the exhaustiveness of the trial and the length of the course is considered, it is unsurpassed in the history of the navies of the world.

The Institute of Marine Engineers.—This Institute will hold a conversazione on Friday evening, Dec. 8th, 1893, at the Town Hall, Stratford. Refreshments will be served at 6.30 p.m. and during the evening, and selections of music will be given by the orchestral and quadrille bands. The grand concert and entertainment will be given in the large Hall, at 7 p.m., in which the orchestral band will give selections, the Ariel vocal quartette will perform glees and part-songs; vocal solos will be given by Madame Weston, Mr. Franklin Clive, Miss Ethel Bevans, Mr. Herbert Braden, and Mr. Horace Ward. Mr. Arthur Wieland will contribute humorous recitations. Mr. Bernhard Molique Carrodus will give violin solos. Anderton's new Stereoscopic Lantern will be exhibited, and its workings explained by J. M. Gray, Esq. Professor Boys' experiments on "Surface Tension and Bubbles," will be introduced by Dr. Hermann Hoffort, from the Royal College of Science, South Kensington. A ventriloquial entertainment will be given by Prof. Pym. Browning, entitled "Merry Folks and Merry Jokes." The pianoforte will be presided over by Miss Mabel Wiltshire, and the musical directors will be Mr. George Wiltshire and Mr. W. J. Taylor. After the entertainment, dancing will take place in the large hall, from 10 p.m. till 3 p.m.

First-class Torpedo Gunboat "Dryad."—The first-class torpedo gun-boat *Dryad* was floated out of the dock at Chatham Dockyard on Saturday afternoon, October 25th, when the naming ceremony was performed by Miss Cecil Heneage, daughter of Vice-Admiral A. C. F. Heneage, Commander-in-Chief at the Nore. The company present included Admiral and Lady Heneage, Rear-Admiral G. D. Morant (Superintendent of the yard) and Mrs. Morant, Capt. Lord Charles Beresford, and Lady Charles Beresford, Gen. G. W. Forbes, Col.-Commandant Scott, R.M.L.I., and other naval and military officers. The service was conducted by the Rev. J. Matthews (chaplain). The *Dryad*, which is an enlarged and improved type of the *Sharpshooter* class of gunboats, has a length of 250 ft., and width 30 ft. 6 in. The Fairfield Engineering Co. are the contractors for the engines, which are to be of 3,500 H.P. The contract speed is 19¼ knots under forced draught, and 17·5 with natural draught. She has accommodation in her bunkers for 100 tons of coal. Her armament consists of four 4·7 in. guns, and four 6-pounder quick-firing guns. After the ceremony the principal visitors lunched at Admiralty House. The *Dryad* was subsequently taken into basin to be completed during the present financial year.

Torpedo-boat Destroyer, the "Daring."—On October 25th, the new torpedo-boat destroyer, the *Daring*, built and engined by Messrs. John Thornycroft & Co., left the ways and was successfully launched from their shipyard at Chiswick, Mrs. Thornycroft, wife of the senior partner of the firm of builders, performing the naming ceremony. Shortly after 3 o'clock, the hour fixed for the launch, the Rev. W. L. Dale, vicar of Chiswick, read the service appointed to be used at the launching of ships of Her Majesty's Navy. This concluded, Mrs. Thornycroft, before releasing the vessel, made a presentation of the Royal Humane Society's silver medal to Mr. Smith, for having at great risk saved a young marine from drowning, who had fallen overboard from H.M.S. *Speedy* during her trials at Sheerness. Mrs. Thornycroft having named the vessel with the usual ceremony, the *Daring* began to move, and continued to glide down the ways until she finally took the water amid the cheers of the large company of spectators present. The *Daring* is, up to the present date, the second vessel launched of her special type. Her principal dimensions are:—Length on the load water-line, 185 ft.; beam, 19 ft.; and displacement at a mean draught of 6 ft. 220 tons. She will be fitted by her builders with triple-expansion twin engines of the four-cylinder type, to develop 3,500 I.H.P., supplied with steam of 210 lbs. pressure per square inch by three double-furnaced water-tube boilers on Mr. Thornycroft's patented principle. Her armament will consist of one 12-pounder quick-firing gun amidships forward, and three 6-pounder similar guns, two of which are forward and one aft, provision being also made for two more on her broadsides. She is also fitted with three torpedo tubes for 18-in. torpedoes. Her estimated speed is 27 knots. The crew of the new class of vessels to which the *Daring* belongs, is to consist of 42 officers and men.

Quick despatch in Engineering.—A thrust shaft 10 ins. diameter and 10 ft. long was commenced in Palmer's Shipbuilding and Iron Co.'s Forge at 6 a.m., Oct. 17th last. The forging was finished and completely machined by 3 p.m. on the the 19th, or 57 hours from first starting. The shaft was sent by rail to London, and put on board the export steamer in the Royal Albert Dock at 7 a.m., Oct. 20th—73 hours from commencing to make the forging. This seems to be one of the most expeditious pieces of work observed for some time, and shows what can be done.

Electrical Communication with Lightships.—Two vessels are being prepared, under the direction of the Trinity House, to relieve the lightships at the North Goodwin Sands and the Kentish Knock. The new ships are being built under contract, and they embody many improvements upon the lightships of older type, each being supplied with powerful syrens, the one for the North Goodwins being worked by steam, and that for the Kentish Knock by a carolic engine. Both vessels will be in direct electrical communication with the shore, the cable from the North Sands having its land connection at Dumpton Gap, and that from the Kentish Knock at Kingsgate Bay. The Post Office authorities will lay the cables, and the cost of the work and maintenance charges will be defrayed out of moneys specially voted for the purpose by Parliament. For nearly 20 years the Goodwins have been protected by four lightships in addition to intermediate nun buoys. The vessel at the North Sand Head is the oldest, having been established exactly 100 years; the *Gull* lightship took up its position in 1809; the lightship at the South Sand Head was moored there in 1832, and the one on the easterly side of the bank in 1874, the number of wrecks diminishing as each additional light was brought into use.

Ice-breaker.—On October 24th, Messrs. Janssen & Schmilinsky, Steinwarder, Hamburg, launched the new steel ice, breaker, *H. and T. Seivers*. The vessel, which is 50 ft. long will be fitted with engines of 180 H.P.

Armour-clad Vessel "Hagen."—On the 21st October there was launched at the Imperial Dockyard, at Kiel the armour-clad vessel *Hagen*, built for the German Navy. The vessel is 289 ft. long, 48·8 ft. beam and 17·3 ft. deep, with a displacement of 3,495 tons. The vessel, which has twin screws, has been constructed of Krupp steel. Motive power will be supplied by engines of 4,800 H.P., by which a speed of 16 knots is expected to be attained. The armament will comprise three 24 c.m. guns, several quick-firing guns, two Maxim guns, and four torpedo-tubes.

New Steamer for the South African Mail Service.—The Union Steamship Co., Limited, have ordered from Messrs. Harland & Wolff, of Belfast, a new steamer for their mail service between England and South Africa. This new vessel will be called the *Norman*, and will be a twin-screw steamer constructed of steel. The leading dimensions of the *Norman* will be:—Length between perpendiculars, 490 ft.; breadth moulded, 53 ft.; depth, 37·6 ft. Her gross tonnage will be about 7,500 tons. She will carry large numbers of passengers in each class. The first and second-class accommodation will be amidships, thus ensuring quietude, comfort, and ample ventilation. The third-class passengers will be carried on main deck, forward. The *Norman* will be fitted with two sets of triple-expansion engines, expected to develop great power and high speed, but at the same time she is designed for carrying a large cargo or considerable number of troops. The vessel will be constructed with poop and forecastle, and will have central deckhouses containing dining-saloons, &c., over which will be an exceptionally fine promenade deck. There will be nine watertight bulkheads, and the ship will be provided with water ballast, and all the most recent appliances and fittings. Electric light will be installed throughout, and there will also be refrigerating engines and machinery, and cold chambers for the ship's stores, as well as for the conveyance of fruit and other perishable goods. The *Norman* will be provided with boats in excess of the Board of Trade requirements.

The "Lucania" and "Campania."—The Cunard steamer *Lucania* arrived off Queenstown on the 18th November, after a protracted voyage, occupying 6 days 14 hours and 40 minutes. She experienced terrific weather. Altogether twelve people were treated for injuries by the ship's surgeon. One of the steerage ventilators was washed away, and a quantity of water got into the compartment. Captain M'Kay says the weather

he encountered was the worst he has experienced in the Atlantic. Violent easterly gales, with enormous head seas, buffeted the huge steamer throughout the voyage, and retarded her progress by 26 hours. The severe weather in the Atlantic was also experienced to the full by the Cunard Co.'s steamer *Campania*, crossing to New York. The following is an extract from the *Campania's* log:—"Passed Daunt's Rock at 1.6 p.m., November 12, and Sandy Hook Lightship 5 a.m., November 18. Passage 5 days 20 hours 29 minutes. Runs 501, 526, 523, 504, 381, 349; two last days strong gales, high seas."

Russian Armour-clad the "Three Saints."—The first-class armour-clad, the *Three Saints*, engined by Messrs. Humphrys & Tennant, has been launched at Nikolaiev, and when she is completed and added to the Black Sea Fleet, Russia will then have no less than six first-class battleships in the Black Sea, besides gunboats, torpedo catchers, and torpedo-boats. At least one more vessel of large size is to be laid down shortly in those waters, and in estimating the balance of power in the Mediterranean it is impossible to leave altogether out of consideration this very powerful fleet, which, directly or indirectly, may make its force felt when the great struggle for supremacy comes.

Institution of Electrical Engineers.—On Wednesday evening, November 22nd, the members of the Institution of Electrical Engineers dined together at the Freemasons' Tavern, the president, Mr. W. H. Preece, F.R.S., being in the chair. The guests of the evening were Mr. Arnold Morley, Postmaster-General, and Mr. Mundella, President of the Board of Trade. The dinner was well attended, and many capital speeches were made, Mr. Mundella acknowledging, in very handsome terms, the indebtedness of the Board of Trade to the Institution for advice and assistance in settling difficult questions.

Award World's Fair, Chicago.—We understand that the Magnolia Metal Co., having offices in New York, Chicago, London, and other places, has been awarded the highest award possible at the World's Fair, Chicago, on its Magnolia Metal. A medal has been granted and a diploma with the following specifications allowed and set forth:—First, it prevents hot boxes. Secondly, it will not cut nor heat journals. Thirdly, its lasting qualities are of the highest order. Fourthly, it is a self-lubricating metal saving a large percentage of oil. Fifthly, it increases the motive power. Sixthly, it is the only metal that protects and does not wear journals. It enamels them. Seventhly, it is adapted to high and low machinery. Eighthly, it will stand the heavy work of sugar rolling, saw and wire mills. Ninthly, it is a success for main journals and crank pin bearings; also gibs of steamships and steam tugs. Tenthly, it is the best water-metal.

The American Society of Naval Architects and Marine Engineers.—The first general meeting of this Society was held at the rooms of the Institution of Mechanical Engineers, 12, West Thirty-first Street, New York, on 16th November and following days. Pressure on our space prevents our giving detailed account of the proceedings at this meeting, but the list of papers for reading and discussion was as follows:—1. "Transatlantic Navigation," by Chas. H. Cramp, Esq., President of the William Cramp & Sons' Shipbuilding and Engineering Co. of Philadelphia. 2. "Steel Ships of the United States Navy," by Theodore D. Wilson, formerly Chief Constructor U.S.N. 3. "Shipbuilding on the Great Lakes," by John F. Pankhurst, Vice-President and General Manager of the Globe Ironworks, Cleveland. 4. "Notes on the Machinery of the new Vessels for the United States Navy," by Commodore Geo. W. Melville, Engineer in Chief U.S.N. 5. "Coal Bunkers and Coaling Ships," by Albert P. Niblack, Lieutenant U.S.N. 6. "Production in the U.S. Navy of heavy Steel Engine, Gun, and Armour Forgings," by Russell W. Davenport, Esq., Vice-President of the Bethlehem Iron Co., South Bethlehem, Pa. 7. "Determination of the approximate dimensions of a vessel to fulfil a given programme of requirements," by Joseph J. Woodward, Naval Constructor, U.S. Navy. 8. "Comparative performances of American and Foreign Freighting Ships," by William W. Bates, late Commissioner of Navigation. 9. "The wetted surface of Ships," by David W. Taylor, Naval Constructor, U.S.N. 10. "The influence of speed and weight of Machinery on the determination of the other elements of the design of Steam Vessels," by Jno. J. O'Neill, Esq. 11. "United States Treasury Rules for the inspection of Machinery and Boilers," by James T. Boyd, Esq., General Manager of the G. F. Blake Manufacturing Co. Papers were also read by Colonel Edwin A. Stevens, President of the Hoboken Ferries, and by Messrs. A. Canfield and J. H. Lennard.

The Cessnock Docks.—On October 31st an important step was taken in connection with the extension of Glasgow Harbour, when the final copestone was laid of the north basin of the new dock at Cessnock. The ceremony marks the completion of the first stage of the works, and in consequence was made the occasion of a demonstration, to which all the Trustees of the Clyde Navigation were invited. The company assembled at Glasgow Bridge, and were taken to the dock on one side of the harbour steamers. The north basin of the dock, although not finished, had been in use for some time, and the laying of the copestone was a formality which was only required to signalise the formal completion of the basin. In the absence of Lord Provost Bell, the proceedings were directed by ex-Lord Provost Ure, the Deputy Chairman of the Trust. In our September issue we have given a full description and plan of the Cessnock Docks.

Second-class Cruiser "Flora."—On Tuesday, November 22nd, there was successfully launched from the dockyard at Pembroke, by Mrs. Fitzgerald, the wife of Capt. Penrose Fitzgerald R.N., Superintendent of the Dockyard, the new second-class cruiser *Flora*, one of the twenty-eight of this class ordered under the Naval Defence Act of 1889, and the last of this description to be launched at Pembroke under that Act. The *Flora* is sister ship to the *Cambrian*, launched in January last. Her principal dimensions are:—Length between perpendiculars, 320 ft.; extreme breadth, 49 ft. 6 in.; mean draught, 19 ft.; and displacement, 4,360 tons. She is to be fitted with triple-expansion engines by the Barrow Naval Construction and Armaments Co., to develop 7,000 I.H.P. under natural draught, and 9,000 under forced draught. Her armament will consist of eight 4·7 in. and two 6 in. quick-firing guns, and several smaller ones to complete her auxiliary armament. The ship has been built from the designs of Mr. W. H. White, C.B., Director of Naval Construction, under the personal direction of Mr. F. C. Froyne, Chief Constructor of the Dockyard.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from October 12th, to November 16th, 1893.

19123 R. Stewart and F. M. H. Jones. Covering boilers.
19156 W. S. Laycock. Steam reducing valve, &c.
19160 H. A. Wood. Ships.
19162 S. Griffin. Combination of screw propellers.
19165 F. G. Stoney. Suction dredging apparatus.
19166 F. G. M. Stoney. Floating derrick cranes.
19167 C. R. Winn. Lubricators.
19169 F. E. Adams. Steering steamships, &c.
19176 C. R. Winn. Water gauges.
19179 J. Williams. Ship propeller.
19183 A Muirhead. Submarine cable apparatus.
19192 W. C. Stiff. Tube joints of steam boilers.
19249 E. Makin, jun. Steam generators.
19262 J. Roots. Internal combustion engines.
19271 J. Moles. Motor.
19289 W. Allman and E. Deeley. Metallic tubes.
19292 L. Beyer. Propelling apparatus for vessels.
19297 G. H. Jones. Crank shafts of steamers.
19309 F. J. Rust. Joining metal tubes or pipes.
19362 E. J. Warmington. Propulsion of ships.
19365 F. Taff. Propelling vessels.
19379 J. H. Owen and D. R. Todd. Steam boilers.
19381 J. Salzman. Steamers' floating appliances.
19402 R. H. Abbott. Water gauges.
19421 I. Wilderspin, sen. Boat releasing apparatus.
19428 O. Phalp. Deck plates for iron vessels.
19477 F. S. Pett. Boat lowering, &c., gear.
19494 J. Shaw. Lighting and ventilating ships.
19510 D. F. Phelan. Artificial atmospheric propeller.
19513 E. J. Oates and L. Binns. Steam boilers.
19514 C. S. Hall. Ascertaining draught of ships.
19588 T. Corkish. Self-indicating compass and callipers.
19638 J. Jerram and T. Furner. Steam radiators.
19646 T. Harris. Bolts for boiler, manholes, &c.
19683 H. Bowden and W. Boby. Governing apparatus of compound steam engines.
19695 E. E. Gold. Steam radiators.
19721 R. H. Woods. Ship's steering apparatus, &c.

19738 F. L. Parkinson. Oil feeding apparatus for boiler furnaces.
19758 W. M. Angus. Securing steam boiler tubes.
19799 A. J. Boult (J. D. Jones, India). Composition for covering boilers.
19853 A. E. Seaton. Water-tube steam boilers.
19899 G. Robson. Marine engine shafts.
19903 J. Frew. Valve gear for steam engines.
19908 S. A. Houghton. Speed indicators.
19953 G. M. Capell. Centrifugal pumps.
19957 E. Bastein. Steam pumps.
19977 R. Baird and J. Cochrane, jun. Ejecting oil on troubled waters.
20029 F. Egge. Manufacture of "Cable Chain."
20030 E. J. Bird. Metallurgical, &c., furnaces.
20037 R. W. Gorton. Improved safety clutches.
20067 T. A. Hince. Measuring vessels.
20068 H. H. Lake (G. F. Simonds, United States). Metallurgical furnaces.
20073 C. J. F. de Vos. Securing boats on ships.
20085 C. A. de L. C. de Lambert. Boats and vessels.
20088 D. B. Morison. Supplying air to furnaces.
20112 C. McLaren. Asbestos and other packing.
20125 J. Angus. Construction of war vessels.
20141 W. and E. Allday and A. Davy. Boilers, &c.
20162 O. E. Pohl. Burning fuel in steam boilers.
20185 F. E. Whitham. Propulsion of ships.
20205 A. Howat. Lubricators.
20220 J. Dixon. Bunkering steamers.
20253 W. M. Walters and F. R. Stone. Coating for steel.
20267 G. Twigden. Packing the glands of engines.
20293. A. J. Boult (L. Pulcini, France). Slide valves, &c.
20294 W. P. Thompson (W. Frost, South African Republic). Multitubular boilers.
20329 L. J. E. Haase and J. A. A. Keimer. Ship's seats.
20362 H. & A. J. Goldthorp. Metallic tubes.
20390 A. J. Boult (The Actien Gesellschaft der Dillinger Hüttenwerke, Germany). Casting of steel.
20399 H. E. Newton (C. C. Worthington, United States). Feed water apparatus.
20414 B. H. Thwaite and J. B. Furneaux. Generating steam.
20430 J. Whyte, H. Whyte, and A. W. Cooper. Regulating apparatus for steam engines.
20433 T. Ryland. Feed pumps for boilers.
20435 J. Lefeaux. Propulsion of ships or vessels.
20447 T. Vernon. Screw propellers.
20463 H. E. Lester and T. J. Terrell. Derricks.
20505 S. Ingersoll. Thrust bearing for shafts.
20522 J. Blake. Oil burning apparatus for boilers.
20650 C. Gardner. Improvements in ships' davits.
20665 J. M. H. Newbart. Feeding coal dust to furnaces.
20682 H. R. Hall. Boiler feeding, &c., apparatus.
20684 E. Commelin. Furnace for smelting ores.
20691 J. O. Kelly. Applying rams to ships or boats.
20695 W. von Essen. Cleaning steam boiler tubes.
20702 H. Wilms. Steamer, boiler, and other furnaces.
20713 W. H. Thompson and G. Morris. Propelling boats.
20724 J. H. Lord and S. Harrison. Preventing ships from sinking.
20732 W. Aldred. Ship's sounding apparatus.
20776 L. W. Lindop. Screw propellers.
20805 T. F. Best and J. C. Bourne. Ship's scuttle ventilator.
20860 J. Thompson. Armoured flexible hose.
20861 D. C. F. Wulff. Valves.
20881 H. Rauser, C. Wieber, and A. Sokoloff. Pressure gauges.
20907 C. B. H. Czichos. Valves for vessels under pressure.
20986 Tangyes, Ltd., and J. W. Floyd. Steam pumps.
20997 J. McKay, A. Hardy, A. Young, and M. S. Dryden. Tube expanders.
21031 A. Room. Indicators.
21058 A. J. Boult (X. Meny and G. Versluys, Belgium). Composition for the prevention of boiler incrustation.
21139 W. T. Bothwell. Engineer's brake valves.
21151 J. M. Stratton. Feed-water heaters for boilers.
21152 W. M. Greaves. Steam boilers and furnaces.
21173 B. M. Drake and J. M. Gorham. Propelling apparatus.
21175 E. Schneider. Thrust bearings.
21189 E. Davies. Obtaining motive power from tides.
21220 H. Concanon. Ship's berths, or state-rooms.
21253 C. E. Owens. Boiler feed and other pumps.
21279 H. R. Chubb. Boiler feeding apparatus.
21295 J. R. Alderdice. Motor.
21299 C. F. Amos. Signalling at sea.
21311 S. Houghton. Differential speed indicator.
21322 J. R. Clay. Valves.
21337 A. L. Térand. Making Helicoid propellers.
21347 T. Coates. Furnace door protecting shields.
21352 L. W. Mallasee. Method of casting steel.
21426 J. Imeson. Propeller for marine propulsion.
21431 T. Taylor. Steam boilers and furnaces.
21439 J. Buchanan and C. W. Buckle. Anchors.
21440 J. Buchanan and C W. Buckle. Mooring buoys.
21470 W. H. Lindsay. Improved reversing gear.
21477 C. Spinks. Improved propeller blades.
21510 R. J. Urquhart (P. F. Schmidt, France). Propellers.
21536 V. F. Lassus. Screw propeller.
21571 G. P. Gardner. Preventing scales in boilers.
21629 P. B. Delany. Sub-marine, &c., telegraphy.
21668 W. E. Syer. Raising sunken vessels.
21672 L. Mason. Swimming and life-saving belt.
21673 T. Hall and W. Patterson. Reducing valves.
21674 D. B. Morison, J. F. Kitching, and C. E. Smith. Propeller shafts.
21690 A. Birbeck. Improved screw propellers.
21694 W. Ward & Sons, & W. Ward. Lubricators.
21717 A. J. Boult (C. W. Whitney, United States). Boiler tube protectors.
21725 J. Rodgers. Fixing the ship's position upon a chart.
21807 R. Deane. Apparatus for saving life at sea.
21864 R. C. Sayer. Working bulkhead doors.
21875 H. Hutchinson. Anchors.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1C, denotes First Class; 2C, Second Class

November 4th, 1893.

Allison, J. H...	2C	Glasgow
Ashton, A. W..	2C	London
Barclay, G. ..	2C	Glasgow
Comrie, P.	2C	,,
Connil, Peter..	2C	London
Crombie, W. ..	1C	,,
Dickie, W. F.	2C	Glasgow
Edwards, Owen	1C	Liverpool
Evans, William	1C	London
Glenday, W. ..	1C	,,
Harvey, John P.	1C	Liverpool
Johnston, D. ..	2C	Glasgow
Legat, C. E. ..	1C	N. Shields
MacKenzie, A.	1C	London
Maddison, J. ..	1C	N. Shields
Michie, James	1C	London
Miller, C.	2C	N. Shields
Morgan, David	1C	London
Patrick, A. ..	1C	Glasgow
Pickett, T. H...	1C	London
Plate, J. H. ..	1C	N. Shields
Sands, James..	1C	Liverpool
Squire, G. E.	1C	N. Shields
Sturrock, C. J.	1C	Glasgow
Trolan, G.	1C	,,
Wright, J. W.	1C	Liverpool

November 11th, 1893.

Allison, H.	2C	N. Shields
Atkinson, W. ..	1C	,,
Campbell, S ..	2C	,,
Cooper, J. H. ..	1C	,,
Crowder, H. J. T.	2C	Hull
Cunningham, D.	1C	Leith
Don, Jno.	1C	London
Ferrier, David G.	2C	Liverpool
Hicks, E. J. ..	1C	N. Shields
Jamieson, A. K.	2C	Leith
Kay, Wm. ..	1C	London
Leggat, Chas.	1C	Leith
Marley, F. C...	2C	N. Shields
Milburn, A. E.	2C	,,
Moore, C. C. ..	1C	,,
Pulley, F. W.	2C	London
Watson, C. Y.	2C	N. Shields
Welch, Andrew	2C	Liverpool
Wilson, Thomas	2C	,,

November 18th, 1893.

Alder, John G.	2C	N. Shields
Alevias, G.	2C	Cardiff
Andrew, Thos.	1C	Dublin
Bates, Wm. T.	1C	London
Brian, A. J. ..	2C	,,
Brown, James..	2C	Greenock
Cardean, R. A...	1C	,,
Cheesman, J. W.	1C	London
Cooper, Wm. D.	1C	Dublin
Delacherois, R.	1C	,,
Dunlop, H. A.	2C	London
Edward P.	1C	Greenock
Evans, Thomas	1C	Cardiff
Flanagan. Hy.	1C	Liverpool
Green, Thomas	2C	,,
Hewitt, Alfred	1C	London
Huntley, Joseph	1C	N. Shields
Hutton, J. C...	2C	London
Jones, Edwin..	2C	Dublin
Kelly, Henry ..	2C	N. Shields
Lewthwaite, G.	2C	,,
McKenzie, A. ..	2C	London
Nicholson, J. N.	2C	N. Shields
Nicolson, W. ..	2C	Greenock
Paterson, A. A.	2C	London
Paterson, H. M.	1C	Greenock
Rogers, Wm. ..	1C	N. Shields
Sheriff, John W.	1C	,,
Smart, Alfred	1C	London
Smith, John ..	1C	N. Shields
Storrier, James	1C	Greenock
Surman, J. S...	2C	Cardiff
Taylor, James	2C	Greenock
Vicary, Walter J.	1C	London
Williams, H. T.	2C	Dublin
Willis, J. E.....	2C	N. Shields

The Marine Engineer.

LONDON, JANUARY 1, 1894.

THE Institute of Marine Engineers are ably fulfilling one of the objects for which they exist as a corporate body, viz., to effect the maintenance and improvement of the status of Engineers of the Mercantile Marine. An interesting paper on the above subject has been read by Mr. T. W. Fish, before the Institute, advising joint action of the members to press upon the Board of Trade the amelioration of such conditions as may be considered disadvantageous to the efficiency and derogatory to the dignity and self-respect of the engineer. The introduction of steam navigation has created a new class of seafarers, who formerly were not required, or who, upon the first introduction of steam power were in charge of what was merely an auxiliary to the sailing power of vessels. Now the propelling and auxiliary machinery and boilers represent a very considerable part of the total monetary value of a steamship, and the charges due to their efficient maintenance and general working constitute her main spending department. Although the necessity of having a duly qualified and certificated engineer to undertake the responsible control of this important department is admitted and recognised by Act of Parliament, there appears to be the strange anomaly that the engineer has no recognised legal status as one of the administrative officers of the ship. In this way, although the engineer has sole responsibility for the working and maintenance of the boilers and engines on which the life of the ship often depends, and all the various auxiliary engines, upon which the proper steering, lighting, loading, or discharging of the ship depends, he is yet not in a position to reprimand or punish of his own authority, the men who work under his sole direction. No engineer's shop or engineering installat on could exist for a moment on land under such conditions in a state of efficiency, nor would engineers, responsible for the due working of such installations, for a moment submit to such conditions. If the marine engineer desires to punish an offender amongst those directly working under him, he must approach the master or mate (usually the latter), state his case, and beg of him to fine and officially log the delinquent, who thus becomes witness of the impotence of his immediate superior to personally deal with him. If the mate make the entry in the log he will have to place it before the master for his signature and approval. To the feelings of a chief engineer possessed of proper regard for personal dignity and also due appreciation of his position of trust and responsibility, such a course is repugnant, and consequently he will not incur the risk of exposing to his subordinates the weakness of his position, unless the extreme exigency of the case should compel him. This is surely not in the interests of the shipowners. Those who have had experience in the charge of steam boilers know how much the economy of fuel and efficiency of evaporation depends upon the careful work and energy of the stokers. If these men are to be allowed to follow their own devices, because it is such a formidable and unpleasant matter to exert any form of reprimand or discipline upon them, who suffers? The shipowners, of course, in the wasteful consumption of fuel and consequent costly charges per voyage. The engineer's status should be legally defined and he should be invested with the control of the engine-room staff with power to enforce discipline amongst them. This concession would be but a simple act of justice, and as it would not in any way infringe upon the supreme authority of the master, there would appear to be no reason why it should not be granted if properly pressed upon the Board of Trade by such a representative and powerful body as the Institute. That the Institute is already being recognised as a mouthpiece for the profession of marine engineering is evidenced by the fact that their recommendation for the creation of a third-class certificate for engineers has been so favourably regarded by the Board of Trade, that the latter body has reprinted the memorial presented to them by the Institute and asked for the views of shipowners and marine engineers on the subject. That in the case of the transfer of the *City of Paris* and the *City of New York* to the American flag it should be possible to give as the reason that the engineers were not to be retained because they were not officers, is an insult to the cloth, and in our opinion there only wants a quiet and moderate persistence of reasonable demands by a representative body of the profession to obtain at last that official status and recognition which is already being more generally accorded to marine engineers, both by the public and by shipowners, which has been forced in courtesy by the conspicuous ability and prominence of the services they are now so often called upon to render in case of dire emergency.

IN our issue for June last we pointed out the importance and necessity of a good system of special express trains, and particularly for long-distant parts in England in connection with the departure and arrival of leading ocean liners. We are glad to notice that since then a new route for these trains has recently been started to Southampton *viâ* Cheltenham for the more rapid transit of passengers from the Midlands, North of England and Scotland who wish to save time in their

passages *via* Southampton to America, the Cape, the West Indies, and other distant ports by ocean liners. In the near future if this new route is greatly appreciated, as it is likely to be, faster trains will probably be run upon it, so that further valuable time will be saved by voyagers from and to the Midlands and the North. The direct service of special trains which has recently traversed this route for the convenience of passengers sailing from Southampton by the American Line and the Union Line and the Castle Line to the Cape has been arranged by the Midland and South Western Junction Railway Co's. The trains run alongside the steamers immediately on arrival in sufficient time for embarkation. Now as the competition on the rival routes of Queenstown and Southampton will soon become much keener and as the former track is now the faster to proceed by even by voyagers from the Metropolis and other parts of the South of England and the Midlands, when the two new Cunarders carry them, and as, moreover, the London and North-Western Railway Co. run special "expresses," from London to Liverpool in about four hours and ten minutes for the conveyance of passengers proceeding by these and other Transatlantic steamers; it is, we believe, highly important in the interests of voyagers to America *via* Southampton, who also equally well value the shortening of time in making voyages, that the best facilities should be adopted to convey them to this port as quickly as possible. The time indeed may not be far distant when special express trains in connection with American steamers leaving Southampton may run there from Birmingham, with a short stoppage at Cheltenham only. Perhaps a favourable opportunity will exist for the consideration of this point when the new steamers of the American Line now being built by Messrs. Cramp & Co., of Philadelphia, are sailing between Southampton and New York, and which will be as fast if not faster than the *Paris* and *New York*. Strong, however, as will be the inducement to run improved special expresses, on the Cheltenham and Southampton route, when such new steamers cross the Atlantic, it will be greater still when voyagers by the Queenstown route will make their passages sooner than ever by the forthcoming White Star liners, which will be the fastest ships afloat. It should also be borne in mind that the London and North Western Railway Co. will probably still further shorten their running time in connection with fast liners from Liverpool by driving their special expresses from London to that port in about four hours. If coming Transatlantic liners make Bristol a port of call, as some think they may do, the Midland Railway Co. will have an opportunity for holding the first position among British Railway Co.'s as regards the running of fast long distance special express trains in connection with ocean liners, because, firstly, no other company would be likely to compete with them in this respect for passenger traffic from the Midlands and the North; secondly, because they could more quickly than any other company run trains from these districts to Southampton; and thirdly, because they can and do run very fast and special trains occasionally between London and Liverpool, in connection with ocean steamers to America, in only a few minutes shorter time than the London and North Western Railway Co. Very many American voyagers proceed between London and Liverpool by the Midland Railway route, as it is by far the most picturesque. The superior hotel and other travelling accommodation afforded by the company at both places, also causes several additional voyagers to travel between them by the Midland Railway. In connection with ocean liners from Glasgow, excellent expresses are run by the Midland Railway Co., from London with dining cars attached.

Mr. Thos. Mackenzie, Master Mariner, F.R.A.S., has thrown himself vigorously into the enterprise of endeavouring to push technical education amongst mariners by reading a paper before the Shipmasters' Society upon mechanical appliances on board ship. Mr. Mackenzie takes up the subject of elementary mechanics as applied in purchases and other operations on board ship which are under the control of the executive officers, manual power being the agent employed, and he doubtless considers that sailors will more intelligently direct and carry out such operations if guided by a proper appreciation of the mechanical principles on which such operations are based. In this view we quite concur, as we have seen many disastrous accidents in the slinging and lifting of heavy weights chiefly caused by the ignorance of workmen or superintendents of the first principles of mechanical strains involved in such operations. Mr. Mackenzie is necessarily obliged, to make his meaning clear, to give ordinary explanations of the various systems of levers and of the parallelogram of forces, but it is in the application of these simple principles to pinch-bars, capstan-bars, winches, and to the rigging up of spars, derricks and purchases for lifting purposes, that the chief interest consists. The Spanish windlass, the use of wedges, inclined planes, increased in mechanical advantage by the use of a parbuckle, are not forgotten, and the diagrams of various kinds of derricks with different arrangements of topping lifts are interesting to nautical minds. The principle of the various forms of tackle are fully

explained, so that the simplest may estimate the advantage obtained by an increase of sheaves in the travelling block, and many practical hints are given as to the detrimental effect upon a rope of a snatch block of small diameter, and the allowance that must be made from theoretical mechanical advantage to reduce it to its practical effective advantage. In the mooring of ships, too, by dividing the strain with an open hawse upon two anchors, some interesting examples are pointed out, in which in certain arrangements the strain on the hawsers or chains may become much greater than half the mooring strain, or than the strains on the same cables when growing ahead. The sheering of a vessel or the turning of a pier-head by a spring from the bow, with the engines going ahead, are excellent examples of the resolution of forces and eminently suitable to the hearers. The action of the wind on the sails of a vessel and the re-action of the hull or keel are interesting cases of the resolution of forces, enabling, as we know, vessels of certain rig to sail very close into the eye of the wind, and we have no doubt that the handling and setting of sails and yards would be more effectively done by both officers and men where there is an intelligent appreciation of the mechanical problems conducive to the best result. As Mr. Mackenzie says, in these days of sharp competition there is no time to test derricks or purchases by trial or error, but they must be arranged and calculated beforehand to suit requirements. We quite concur with Mr. Mackenzie that there is no profession which gives so much scope for scientific study as that of the sailor, as his practice involves mechanics, mathematics, astronomy, magnetism, meteorology and many cognate sciences.

THE OPENING OF THE MANCHESTER SHIP CANAL.

THE opening of the Manchester Ship Canal marks the successful completion of one of the most important engineering enterprises of modern times. The construction of the Canal has occupied just six years, the cutting of the first sod at Eastham having been performed, without any ceremony, in November, 1887, and on the 9th December last the Directors, again without any ceremony, virtually opened the Canal by proceeding, by steamer, along its entire length, from the Locks at Eastham, to the docks in Manchester and Salford. This was followed, on the succeeding Saturday, by what in reality may be regarded as a public opening of this important waterway, when the representatives of the Press from all parts of the country were, by the invitation of the Directors, conveyed from Liverpool on to Eastham, and through the full length of the Canal to Manchester and Salford, and to-day the Canal is opened for general traffic. The project for bringing Manchester into direct water-communication with the sea is by no means of modern growth, and the completion of the Canal is the realization in concrete form of an idea nearly 180 years old. As an engineering scheme, the construction of the Canal has probably had no parallel in magnitude and difficulty for the last twenty years, but the mere labour of making the 35½ miles of waterway has been scarcely less arduous than the struggles, perils, and vicissitudes which the company have had to encounter and overcome. Mr. Daniel Adamson, the first chairman and chief promoter, whose name will ever be associated with the work, did not live to see its completion, and he was pre-deceased by Mr. T. A. Walker, the contractor. To obtain the Bill authorising the construction, it required six Parliamentary enquiries, and a struggle which was unexampled in the history of Private Bill legislation. The costs of the contest to the promoters amounted to over £100,000, and their opponents spent much more. When the Bill was obtained, it appeared very probable that the capital would not be raised, and when—after a hard struggle—the money came in, and the Canal was partially made, there was, on two occasions, a prospect that the works might possibly have to be abandoned. The

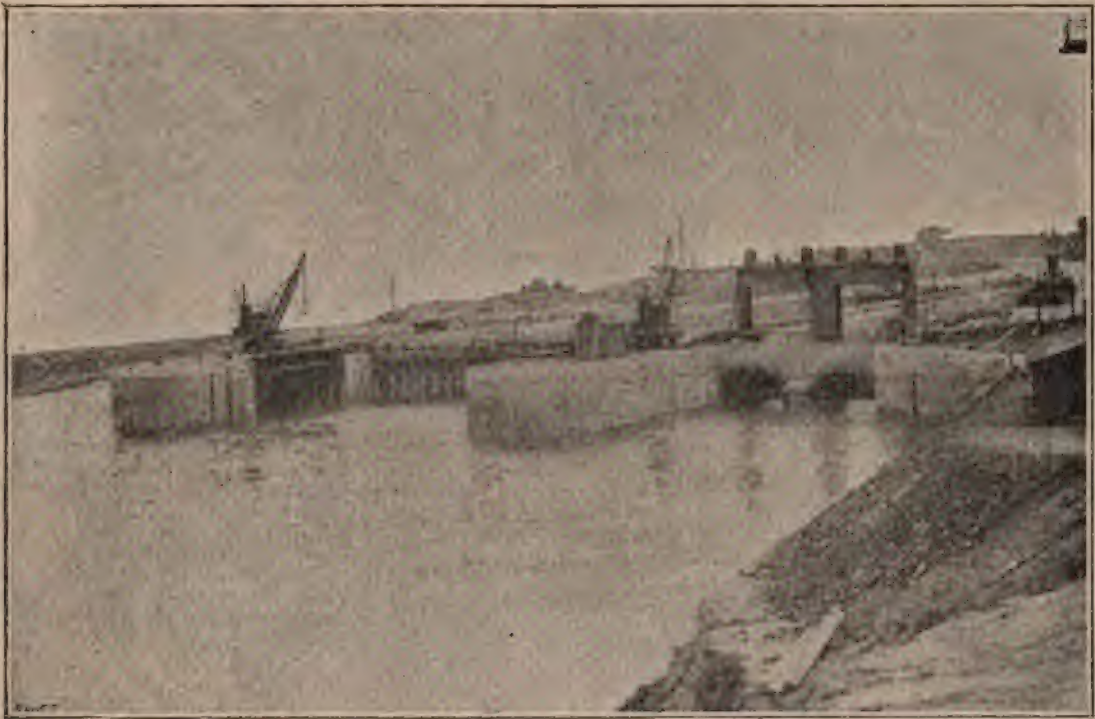
MANCHESTER AND SALFORD DOCKS.

Canal was originally designed to cost £6,000,000; already £15,000,000 have been spent, and the Warrington Docks have not yet been touched. Into the history of the struggles and the vicissitudes which, during its earlier stages, seemed almost to render hopeless the realisation of the project, and which at a later period, very nearly threatened to swamp the whole undertaking, it is not necessary now to enter. What will more interest our readers is some detailed description of the actual engineering work which has now been so successfully accomplished. As we have already stated, the work of making the Canal was formally begun by Lord Egerton cutting the first sod at Eastham, in November, 1887. The contract for constructing the canal was placed in the hands of Mr. T. A. Walker, whose name was already identified with other vast engineering works both at home and abroad, including the construction of the Severn Tunnel, and important engineering operations in South America. Mr. Walker undertook to construct the Canal in four years, and before many months had passed from the placing of the contract, some 15,000 men were engaged in "upheaving" the country at various points along the route. Fifty-one million cubic yards of excavation had to be done, and a fifth of that amount was sandstone rock. To the pick and the spade was added the steam "devil," which could, on an emergency, clear away 2,000 tons of soil in a day. The contractors' plant, which was required to begin operations, was worth between £600,000 and £700,000, and included 100 steam excavators, 173 locomotives, 194 steam cranes, and 209 steam pumps. In addition to the plant already mentioned there were during the busiest period of construction in use 182 portable and other steam engines, 6,300 waggons, 59 pile engines, and 223 miles of temporary railway. The number of men and boys employed was 16,361, the number of horses 196, and 10,000 tons of coal and 8,000 tons of cement were used monthly. For the Canal, which was to be 120 ft. wide at the bottom, and 26 ft. deep, with five sets of locks, 70,000,000 bricks, and 220,000 yards of masonry were required, and the engineering difficulties proved to be unusually great and diverse. For twenty-one miles, between Latchford and Eastham, the Canal is tidal, and receives its waters from the Mersey. For nine of these miles, from Eastham to Saltport, the waterway is artificial and inland, being separated only from the Mersey by a strip of land a few hundred yards wide. At Saltport, where the River Weaver joins the Canal, commences a series of subsidiary waterways, which end with the junction of the Weston Canal, the Shropshire Canal, and the Bridgewater Canal with the larger one. For the fourteen and a-half miles between Latchford and Manchester, the Canal takes the place of the Rivers Mersey and Irwell, after running in their channels—thus making what may be termed a "canalised" river. Round and about Latchford, numerous railways and main roads intersected the waterway; these have been raised, and now proceed along immense bridges, 75 ft. high, and in all, eleven miles of deviation railways have been constructed. At Barton, a splendid engineering feat has been accomplished, a swinging caisson having been substituted for the old Brindley Aqueduct, which formerly carried the waters of the Bridgewater Canal over the river. The Manchester and Salford Docks begin at Mode Wheel, the water here being at one level, and the five miles of its length, and the water space of 104 acres practically forming one huge dock, which will accommodate goods from all parts of the world. This, in brief outline, is a sketch of the project, and we will now proceed to give in detail a description of some of the more important engineering features connected with the construction of the Canal, together with illustrations showing the Locks at Eastham—where the waterway commences in the Mersey; the Barton Swing Aqueduct—which is probably one of the most interesting illustrations of what can be accomplished by modern engineering skill; and the Docks at Manchester and Salford, which form the terminus of the Canal, showing them during the course of construction, and as they are now completed, with landing and loading sheds which have been erected on the quays.

SWING AQUEDUCT AT BARTON. (*See page* 411.)

The main features of the Canal can perhaps be best and most reliably described by summarising the official particulars prepared by the directors on the occasion of the inspection of the waterway by the representatives of the Press, who, as already stated, proceeded on the 16th of last month from Liverpool, by special steamer to Eastham, and then, entering the Canal, were conveyed the whole distance to the docks at Manchester and Salford. The entrance channel at Eastham is at present 16 ft. below

Old Dock Sill, Liverpool, and the navigable depth is ascertainable by adding 16 ft. to the heights of tide given in Holden's Almanac. This channel, when completed, will be 20 ft. below Old Dock Sill, in order to provide access to the Canal at any state of the tide. At Eastham, there are three locks, of which we give an illustration, forming three separate entrances, which are open to the river level whenever the tide rises more than 14 ft. above Old Dock Sill. When the tide is below the 14 ft. level, access is provided by the locks, the largest locks being 600 ft. by 80 ft., the intermediate, 350 ft. by 50 ft., and the smallest, 150 ft. by 30 ft. The lower sill of the large lock is 23 ft. below Old Dock Sill, the upper sill being 28 ft. below the normal water level, and a vessel can be passed through the largest lock in eight minutes or less. The first point of interest after leaving Eastham is Ellesmere Port, which is the terminus of the Shropshire Union Railway and Canal Co., the navigations of which extend to Chester, and through Shropshire into North Staffordshire. The above company have constructed a long length of wharfage fronting the Canal, alongside of which there are 20 ft. of water. At this point there are a pontoon and a ship repairing yard, built by the Pontoons and Dry Docks Co., Limited, the pontoon being 300 ft. long by 70 ft. wide, and all repairs that may be necessary to vessels making use of the Canal may be effected at this point or at Mode Wheel. The whole of the land between the L. & N. W. and G. W. Joint Railways, and the Ship Canal, from the Gowy river westward, to near Ellesmere Port, is owned by the Ship Canal Co., and is available for purposes of traffic. A point of very considerable importance is next reached at Saltport, which is near the junction of the Ship Canal with the river Weaver, the Weston Canal, and the Runcorn and Weston Canal. Wharves and jetties have been constructed here for the transhipment of salt, and it is the nearest shipping place for the salt trade of Cheshire. Minerals, pig-iron, pottery materials, pitch, timber, resin, farina, nitrate, sugar, saccharine, and other traffic is also being dealt with alongside these wharves and jetties, and for the storage of traffic requiring cover, a large shed has been built, no charge whatever being made for the storage of traffic not needing cover. Regular lines of steamers have been running from Saltport to London, Glasgow, and Treport, for Paris, &c., respectively, pending the opening of the Canal for traffic to Manchester. At Weston Marsh, a lock 229 ft. by 42 ft. 8 in., connects the Weston Canal, and the Weaver Navigation with the Ship Canal. Here are also the Weaver sluices, ten in number, which were completed in 1890. They are each 30 ft. wide, rise 13 ft., weigh 50 tons, and include all modern appliances. Their nominal purpose is to pass out into the estuary at this point the same volume of water which entered and left the Weaver before the embankment in front of that river was made, and thus prevent silting, and they could pass 50,000 cubic feet per second. Access to the estuary at Weston Point from the Weaver Docks is given by the Weston Mersey Lock, which is 600 ft. by 45 ft. Passing onto Runcorn, there is here a lay-by, 1,500 ft. long, which is being equipped with cranes and coal tips, and is in direct communication with the L. & N.W. Railway *via* the Ship Canal Co.'s line. The river entrance to the Runcorn Docks, covering an area of 147 acres, belonging to the Ship Canal Co., is formed by the Bridgewater Lock, 400 ft. by 45 ft. At Runcorn, the L. & N.W. Railway bridge governs the height of the high level bridges crossing the Canal, viz., 75 ft. clear from the high-water level. For the Widnes traffic, accommodation is provided by Runcorn Old Quay Locks, 250 ft. by 45 ft. A feature at Runcorn is the embankment, 2,950 ft. long, 16 ft. wide at the top, and rising from a 22 ft. base, and faced by 12 in. piles. At Latchford and Warburton, two high level road bridges cross the Canal, built on the cantilever principle, with 306 ft. spans, and a clear headway of 75 ft. from the water-level. Each bridge weighs 783 tons, and has a roadway 25 ft. wide. There are also seven high-level (75 ft.) railway bridges, with clear spans of from 137 to 266 ft., viz., over the Canal at Acton Grange, weighing 1,946 tons; over the Mersey at Acton Grange, 353 tons; over Canal at Latchford, 1,220 tons; over Canal at Partington, 494 tons; over the Mersey at Glazebrook, 561 tons; over Canal at Irlam, 550 tons; and over river Irwell at Irlam, 426 tons. At Partington, coal tips are put down which will be fitted with the most recent improvements for loading coal, and with hydraulic machinery of sufficient power to discharge 19 tons each tip, accommodation being provided for six tips, four of which have already been constructed. At Barton the Bridgewater Canal is carried over the Ship Canal by means of a steel aqueduct, 235 ft. long, 6 ft. deep, and 19 ft. wide, of which we give an illustration. During the passage of vessels over the Ship Canal the aqueduct is swung on a pivot by hydraulic power, the weight when swinging being 1,400 tons, and the span 90 ft. This aqueduct has taken the place of Brindley's



Locks at Eastham. (*See page* 411.)

celebrated structure, which was built by him to carry the Bridgewater Canal over the river Irwell, at an elevation of 39 ft. from the water level, and which stood for 130 years. This aqueduct, as well as the swing bridge, is worked by hydraulic power. The caisson is filled with water to the same depth as the Bridgewater Canal, and boats pass along it over the Ship Canal. When vessels have masts too high to pass under the caisson, and it is opened like a swing bridge, the water is retained in the caisson by lifting gates at either end—similar gates being used at either end of the aqueduct leading to the movable caisson to maintain the water in the Bridgewater Canal. At Barton Road, a swing bridge provides a 25-ft. roadway, is 193 ft. long, weighs 640 tons, and moves on a radius of 64 rollers. Six other swing road bridges are built on the same principle, each having a span of at least 120 ft., except Trafford Road, which is 75 ft., viz.: Old Quay, Runcorn, 20 ft. roadway, 507 tons; Moore Lane, 25 ft. roadway, 672 tons; Stag Inn, 25 ft. roadway, 672 tons; Northwich Road, 16 ft. roadway, 1,083 tons; Knutsford Road, 36 ft. roadway, 3,083 tons; Trafford Road, 48 ft. roadway, 1,800 tons. The docks at Manchester and Salford, of which we give two illustrations, have an area of 114 acres water space, the area of quay space being 152 acres, and the length of quays is 5¼ miles. The dimensions of the docks respectively are:—Salford: 71 acres' water space, 129 acres' quay area; 3⅝ miles' quay length; arm 1,350, 1,177, 828 ft. long, and 225 ft. wide; quays, 260 ft. wide; Stretford wharf, opposite ½ mile long. Manchester: 33½ acres water space, 23 acres quay area, 1⅝ miles' quay length; arms, 1,620 and 3,571 ft. long, 150 ft. wide; quays, 120 ft. wide. Ordsall Dock, opposite 980 ft. by 750 ft. Concrete has been used wherever practicable in the dock walls. The copings and hollow quoins are of Cornish granite, whilst hard sandstone from Yorkshire, Derbyshire, and Cheshire quarries, and limestone from Wales, are used in other parts of the work. All of the brickwork is faced with blue bricks. The lower portions of the dock walls are formed of concrete, and the culverts are lined with masonry or brickwork. At the water level, granite or limestone fender courses, which slightly project from the face of the wall, are inserted to protect the concrete facing. Above this level the concrete walls are lined with brickwork, and in the upper portions of the dock walls, culverts are built for hydraulic and gas mains.

The illustrations are from photographs kindly supplied by Mr. J. Ambler, 7, Market Street, Manchester.

Salford Docks During Construction. (*See page* 411.)

THE FLEETS OF THE MAIL LINES.

THE Union Liner *Tartar*, after some ten years' work, has made the best homeward passage she has yet achieved. A paper that devotes itself to shipping, and which ought to know better, has published her performance as the "record from the Cape to Plymouth." This paper has probably never heard of the *Scot*. Nevertheless the run was a very good one for an old boat and deserves to be chronicled. The time was 17 days 1 hour, and the speed exceeded 14½ knots.

When speaking of fast passages we must not forget the maiden passage of *La Navarre*. She ran from Corunna to Havannah in ten days, and maintained an average of some 16¾ knots.

The *Exmouth*, whose sale we announced as a fixture last month, only realized some £940. This is not altogether encouraging to owners. Yet it is quite obvious that very low prices will have to be accepted for many old vessels before any real improvement in freights can be looked for.

The *Staffordshire*, the new crack of the Bibby Line, was launched by Messrs. Harland & Wolff, of Belfast, on the 7th December, and she will doubtless do her part in extending the popularity of the new line. She is a twin screw of the latest type with every convenience for 104 saloon passengers. Her advent will render the fleet capable of giving the public a steamer of the first class once every three weeks, instead of once a month, to Rangoon, via Marseilles and Colombo.

Mr. Cramp, the shipbuilder of Philadelphia, from whose new American Liners so much will be expected after the great promises which have been made on their behalf in the press, read a paper on them at the first meeting of the American Society of Naval Architects and Marine Engineers. He promised that the vessels should come and speak for themselves in a year, and he was good enough to point out the weak spots in British builders' designs meanwhile. He said the principal fad of British designers was an aversion to statical stability. They make a vessel carry great

quantities of water or other ballast or other unremunerative deadweight to make her stand after they have designed her without initial stability, and this they do, he says, to make her roll easy. The builder who suggests and the owner who accepts a design which contemplates the carriage of water ballast meets with the unsparing condemnation of this designer. His theory is certainly correct. It is ridiculous and extravagant to drag about dead weight which cannot pay for itself, all through the life of a ship when remunerative freight offers. But after all we must remember that the first considerations of these vessels are passengers and mails. Comfort of passengers and expedition in the delivery of mails. These are the great aim. If the sacrifice of a few hundred tons of paying freight (paying the ridiculously low rates which are the rule in these times), will save coal or dues or working expenses, or will contribute to the comfort and safety of the ship, then the extravagance may be apparent only. He also said, and said truly, that the limit of size, as long as the draught of water was restricted as at present by the New York Bar, was reached in the new Cunarders. But the remarks that he made as to the new vessels and their performances will have to be justified by them. If they do not eclipse the performances of the *Lucania* and *Campania*, and eclipse them too with increased economy, we shall have to put down the greater part of his paper, as reported, as the mere empty cackle of the American eagle over an egg not yet laid. It may prove addled. Our builders for the next twelve months at least are safe in saying *Facta non Verba*. An ounce of practice is worth a whole paper of theory.

The gales of November and December, 1893, are likely to be memorable. The Channel service suffered considerable interruption. The Great Eastern boats seemed to suffer least. That may have been owing to geographical circumstances. This however, does not seem altogether likely. They themselves attribute their good luck to their wisdom in the adoption of the twin screw. Certain it is that the big Ostenders did not fare too well. By the way the names of the two new Great Eastern vessels already referred to as building at Hull, by Messrs. Earle & Co., are to be *Berlin* and *Amsterdam*. They will be the biggest boats employed in the Continental service.

The *Umbria* crossed the bar into Liverpool on the 9th of December, drawing 25 ft. of water, within one hour of low tide. This was claimed as a further nail in the coffin of the bar. An indignant correspondent from Southampton however, claims that does not yet make Liverpool equal the Southern port. He alleges that at dead low water spring tides, the big American liners go in and out regardless of the fact that they are drawing 26 ft. We shall see. The Southampton people seem to find, till they have developed themselves a little more, the advent of the American line with three running vessels and a reserve have exhausted their resources. They have to extend their borders. If whilst they are doing so Liverpool cannot, now it is awake to the competition, make efforts to retain what it has, we must conclude that enterprise in Lancashire is dead, and say, "To the victors the spoils!"

Southampton is not losing any chance of extending its connection or of giving facilities to the travelling public. The beginning of the December saw it extend its Havre service in a way that cannot fail to benefit the railway company and the port directly, and the ocean lines indirectly. Hitherto the Havre boats have sailed and arrived three times a week. Experience show that the boat always leaves the night we don't want to use it, and this is indeed a move in the right direction. The whole policy of the southern port seems to show that if they cannot command success, they at least are leaving no stone unturned to deserve it.

It is pleasant to have to record the success, on the 12th November, of the efforts to get off the stranded mail steamer *Miowera* from the rocks at Honolulu. She was not of course benefitted by her detention there, but when she has, after temporary repairs, been to the graving dock at San Francisco, she will be equal to her old form, and with the *Arawa* and the *Warrimoo* will maintain an exceptionally smart service between our two great colonies.

The ocean yachting business does not seem too prosperous just at present. The company which ran the old liner *City of Richmond* is in liquidation. The editors of the newspapers who took passage this year on the understanding that they would give the company free advertisement in return next season, are to be congratulated, for they have had their holiday and are unlikely to be called upon to fulfil their share of the compact. The ship does not appear as an asset in the company's statement as the vendors claim her, but their assets seem to be some £1,676, whilst the debts amount to £6,209. The expenses of realization and liquidation have also to be met.

It will be observed too that the old *Ceylon*, first and favourite of the private owned ocean yachts, is offered for sale or charter. It is unfortunate, but it was easily to be seen that there were too many steamers in the business. Low fares, and the yachting terms which prevent the carriage of cargo to help the receipts, are a very sufficient explanation of what is happening.

The new White Star liner *Gothic* has reached the Royal Albert Dock *via* Cardiff and Liverpool, and ere these lines are in type will be passed the Land's End on her maiden trip. She is a very magnificent ship and shows the P. & O. Co., and even the owners of the *Ophir*, what a long voyage ship can be. To the P. & O. the suggestion of twin screws is made, whilst to the *Orient* the beauty of her lines and appearance must be a revelation. She does not go in for being a purely passenger ship, but the hundred saloon passengers she caters for will have a very good time. Baths and a barber's shop are of course provided, and on the spar deck are four chambers de luxe, with accommodation and brass bedsteads such as gratify the pride of the wealthy North Atlantic traveller. These rooms are situated at the front of the deck-house and are thus given good ventilation. The saloon has a slight dome and is very tastefully decorated. The reading-room above contains a very handsome library of exquisitely bound books and the usual comfortable corners for writing and reading. This room, like the smoke-room, has the omnibus roof, which gives extra height and thus increased light and air, the latter a great boon in the tropics. The smoke-room is furnished like those on the big Atlantic boats, but with certain improvements—the result of experience. Thus there is a gentlemen's lavatory leading out of the room and a bar adjoining the entrance. The pictures which were such a feature of the older boats are not forgotten. The subjects here are old-world ships connected with the Mediterranean and Southern voyage. The mother of pearl White Star, let into the panel of the seats, is a handsome decoration. There is a permanent wooden awning deck above the promenade, which is thus clear of all encumbrances, and a grand space it is. It is noticeable that hydraulic machinery is not provided for working cargo and that the vessel is steered by a steam engine aft which is controlled from the bridge or charthouse. There is no longitudinal bulkhead in the engine-room, which is thus rendered very airy and spacious. The engines are of the ordinary triple-expansion type with piston valves on the H.P. cylinders only. Feedwater and filtering appliances are of course provided. The three double-ended boilers have six furnaces each and artificial draught can be applied. The ashes are noiselessly disposed of by a patent ash-hoist. Two of Hall's patent refrigerating engines give sufficient cold to provide for the conveyance of no less than 75,000 carcases of sheep. These engines are situated in the tunnel between the two shafts and a little further aft the tunnels fork off into separate paths. No second-class passengers are carried, but the accommodation for crew (especially stewards), and for the third-class passengers, is exceptionally good.

The official report of the Court of Inquiry into the casualty to the *Miowera*, which occurred on the island of Oahu, one of the Sandwich Islands, on the night of the 2nd of October, is now published. The investigation occupied four days, and resulted in a complete exoneration of the ship's officers and pilot. It appears that the lights of the town,—where the electric light is apparently more generally used than in English cities—show a glare visible to a distance of thirty-five miles. The guiding lights for the harbour are visible only to a distance of six or seven for the red and but four for the green. This would be bad enough, but the green light was placed in such a way that masts and spars of ships lying at the wharf could, and on this occasion actually did, obscure them from vessels making the harbour from certain directions. After the stranding took place it was ascertained that the green light when invisible from the bridge had been all the time in sight of those on deck, and corroborative evidence was furnished by Captain Davies, of the steamer *Claudine*, who had had a similar experience, though fortunately he had escaped accident. This may have been owing possibly to the lighter draught of his ship. But be this as it may, the captain and officers of the *Miowera* were acquitted of all blame, and the Hawaian Government will promptly take measures to guard against a repetition of the mistake. It is only the British Government that after such a hint neglects to take warning.

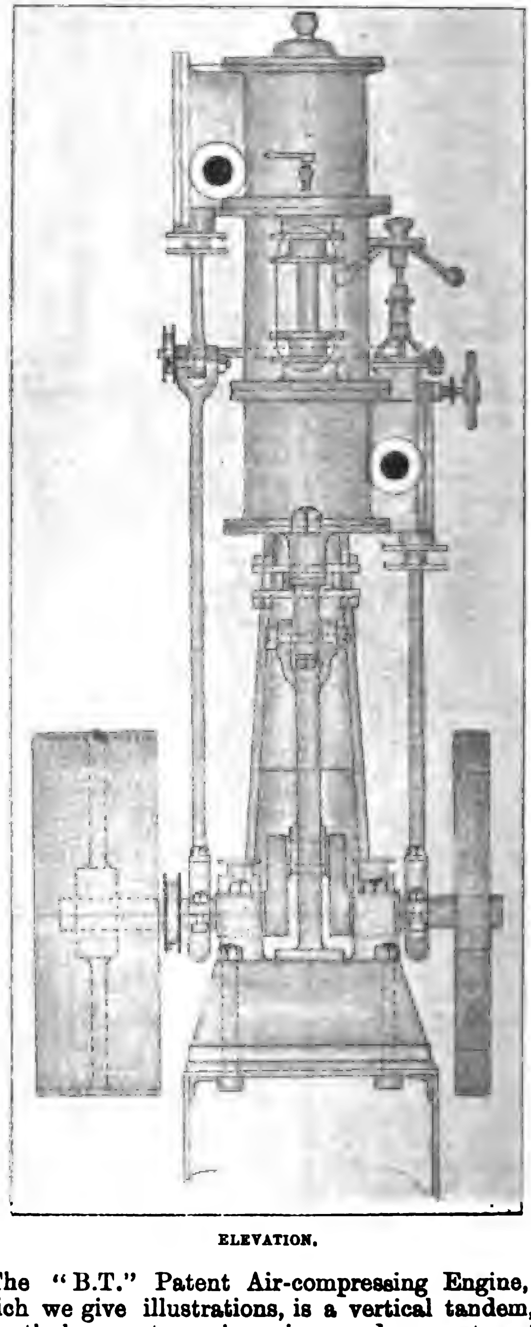
In spite of the wild weather the *Lucania* did well on her last homeward trip this year, though the company did not make any fuss in the Press over her performance. Leaving New York at 8 a.m. on the 9th December, she was off Queenstown at 3 a.m. on the 15th. The weather, however, made it undesirable for her to stop there. Her daily runs were to noon on the 10th, 546 miles; to the 11th, 490 miles; to the 12th, 487 miles; to the

13th, 480 miles; and to the 14th. 500 miles; 300 miles on the 15th brought her to Daunt's Rock. Passage 5 days, 13 hours, 47 minutes.

The Liverpool companies are giving their passengers many little facilities, though they do not seem to publish their good deeds as carefully as those frequenting other ports. For example, when the *Majestic* reached the Mersey three days before the *Lucania* she went straight into a northern dock and landed her passengers. Whence they were dispatched direct (without the tender experiences whose hardships are so much exaggerated). This gave opportunity for the Scandinavian-bound passengers, who were in a hurry to get to Hull, a chance of escaping the customs altogether as far as Liverpool was concerned. By one of those arrangements for which the White Star is distinguished, the baggage was sealed up in special vans by the Customs officials and sent across England in bond, to be again opened by the officials at the East Coast port. If Southampton has done nothing else it seems able to make Liverpool show real form.

THE "BAIRD-THOMPSON" IMPROVED SYSTEM OF SHIP VENTILATION.

RECENTLY a number of gentlemen connected with the profession of engineering and representatives of several large ship-owning firms, amongst whom we observed the Right Honourable A. B. Forwood (Forwood Bros. & Co.); Captain Wilson (Board of Trade); Captain Park (Board of Trade); Mr. D. Meiklereid, M.I.E.N.A.; Captain Hogg (China Mutual); Mr. Martin, naval architect; Mr. J. D. Gray Thompson, C.E.; Mr. John Sturgeon, M.I.E.; Mr. R. N. Shaw, Mr. Robert Pollock, M.I.E. Captain Parsons, etc., etc., were assembled on board the s.s. *Zweena* (Messrs. Forwood Bros. & Co.) in St. Katherine's docks, for the purpose of inspecting the "Baird-Thompson" Improved Patent Combined System of Ship Ventilation, which has been patented by the "Baird-Thompson" Ventilating and Engineering Co., of London and Glasgow, and is the result of many years' close study and experiments. The "B.T." System, which may be briefly described, is a combination of automatic and mechanical ventilation. An entirely new form of deck ventilator or cowl, that never requires trimming, perfectly weather-proof, and which occupies the smallest possible amount of deck space, is used in combination with an improved form of compressed air jet or nozzle, of an entirely new type, and which has no movable parts. The "B.T." patent specially designed Air-compressing Engine, steam driven and placed in the engine-room, generates the compressed air, passing same into a receiver, from whence it escapes through air pipes 1 in. diameter or so, which are led to the various upcast ventilators, and forced through a specially designed air nozzle, situated in the base of the ventilator. By this means a continuous and powerful induced current is created, the vitiated or hot air being rapidly drawn off, the fresh air rushing down the downcast ventilators, of similar type, thereby ensuring a rapid and constant change of the air. Some very interesting tests were made by introducing smoke into the downcast ventilators situated at the aft ends of the holds, and in a most remarkably short time the smoke was drawn from the holds and 'tween decks, and ejected out of the upcast ventilators, situated at the extreme forward ends. The "B.T." system has, in the opinion of the inventors and those present, now been brought to a state of development which comes as nearly perfect as it is possible to finality. The application of the system is very far removed indeed from complication or intricacy of detail. From 3 to 5 per cent. of the air introduced is compressed air, viz., out of every 100 ft. of vitiated or hot air being ejected from the hold or apartment ventilated, only 3 to 5 per cent., according to circumstances, is compressed air, the remaining 97 to 95 cubic ft. of air being induced by the current of compressed air passing through the patent nozzle.



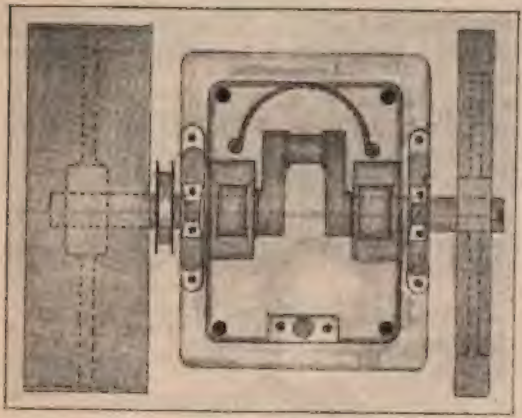
ELEVATION.

The "B.T." Patent Air-compressing Engine, of which we give illustrations, is a vertical tandem, of an entirely new type, is unique and a most perfect piece of engineering. It occupies small space, 3 ft. 6 in. by 2 ft. 6 in. by 7 ft. 6 in. high, and this engine has also been specially built to drive the dynamo for the electric lighting. It works at slow speed and at

low pressure, 4 to 6 lbs. being ample for the work required. These engines can be built vertical or horizontal as required.

Regulating valves are fitted to the system, whereby any given part of the installation can be regulated at will, or shut off entirely, as may be desired.

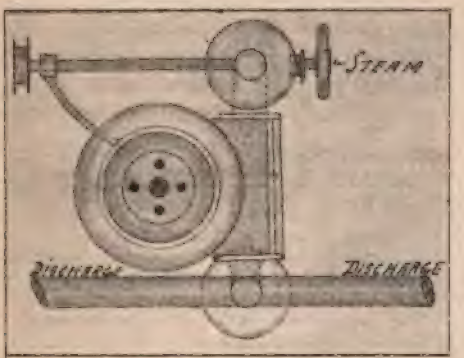
One "B.T." Patent Compressed Air Engine supplies



PLAN THROUGH CENTRE OF SHAFT.

the whole ship's parts, and also can be used for assisted or forced draught to the main boilers.

The gentlemen who attended expressed themselves as highly pleased and satisfied, commending the system as of being thorough simplicity with the very highest possible efficiency, quite different from anything hitherto introduced, and a most valuable aid in the preservation of perishable and other cargo, as well as a great boon to passengers and crew. The s.s. *Zweena* is engaged in the fruit trade. All present seemed to be fully convinced that the "Baird-Thompson" system had a great future, was quite a distinct and new departure, and wherever applied it would prove a most decided advantage and gain to the shipowner. The "B.T." system is sanctioned and approved of by the Board of Trade, Admiralty, etc., and is already being rapidly introduced. One Atlantic firm of shipowners has



PLAN ON TOP OF STEAM CYLINDER.

already introduced the system into the whole of their fleet, giving the greatest satisfaction, so much so, that we are informed they will introduce it in future into all the ships they may possess. We are informed by the "Baird-Thompson" Co., that by their system the air of any compartment may be changed entirely as often as may be desired, from 1,000 to 1,000,000 cubic ft. of air can be removed or introduced per minute, without the slightest draught or inconvenience. We would recommend all interested to pay a visit to the show-

PLAN OF TOP OF COMPRESSER.

rooms of the "Baird-Thompson" Ventilating and Engineering Co., at 159, Queen Victoria Street, E.C., where the system can be seen in operation, and all further particulars obtained.

THE CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

THE annual address of the President (Mr. Reginald Bolton) of this Society was delivered at the opening meeting of its Session, on Thursday, December 14th, and was devoted to the subject of "The Literature of Engineering."

After reference to the value of technical book study in connection with, or in addition to, practical education, Mr. Bolton considered the difficulties that lay in the way of the technical student, by reason of the vast amount of material at his disposal, and the absence of any standard catalogue of works, and of any system of cataloguing and indexing the same.

A Bibliography of Applied Science Works, and Glossaries of technical terms were shown to be needs of the present day, and their publication under the authority of the learned societies was held to be the proper course. A system of guide-books to study, or condensed bibliographies, several of which were suggested to the respectively interested organizations, was advocated.

The question of what not to read was gone into, and led to a consideration of periodic literature, and some of the systems followed in it were condemned.

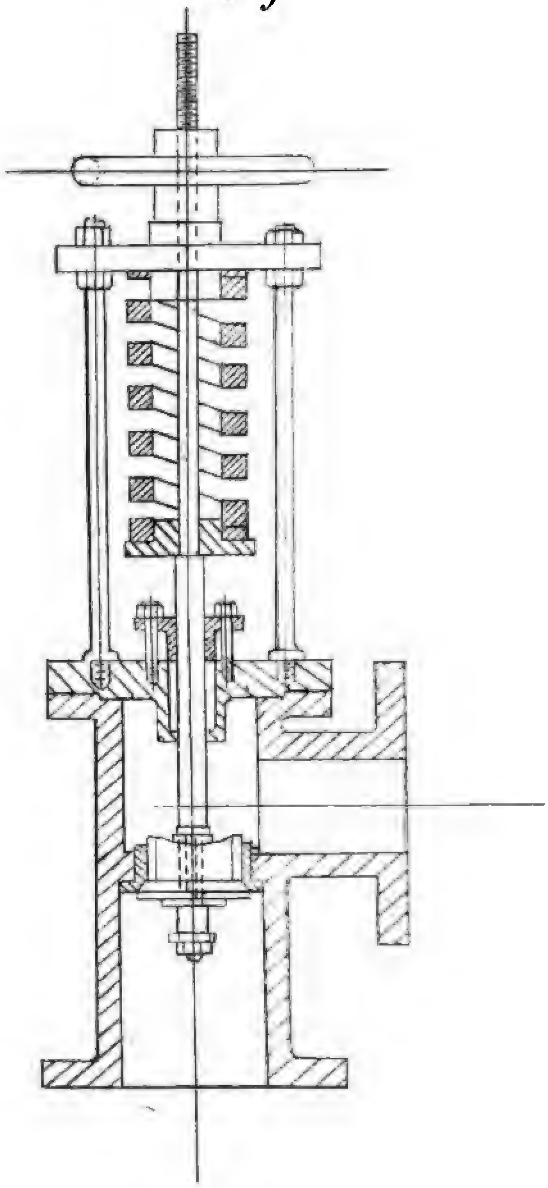
The question of opening and rendering accessible scientific libraries was dealt with, as was the need for greater liberality on the part of certain societies in purchasing books. The address closed with an outline of suggested reading for the young engineering student.

LINFORD'S PATENT AUTOMATIC SAFETY STOP VALVE.

THIS valve, which we have pleasure in bringing under the notice of our readers, is one which will appeal to them as supplying a very long-felt want. The principle employed is very similar to that in safety gauge cocks, though the details are worked out to suit the exigencies of the case. Anyone who has kept watch in the engine-room of a steamer running light, must have noticed the continual movement of the main steam pipe as the engines oscillate to the spring of the ship, and how many have speculated what they would do if a fracture should occur. To shut off the steam at the boiler head is of course the first thing to do, but to accomplish this is by no means an easy feat. With steam at a temperature of nearly 400 deg. Fah. the loss of life below is bound to be great, and one of the chief objects of Linford's automatic valve is to prevent this by instantly closing the stop valve as soon

as a sudden release of pressure on the engine side occurs. Again, in the case of the breakage of a piston rod or shaft when the engineer is, say, up the tunnel,

Fig.1.

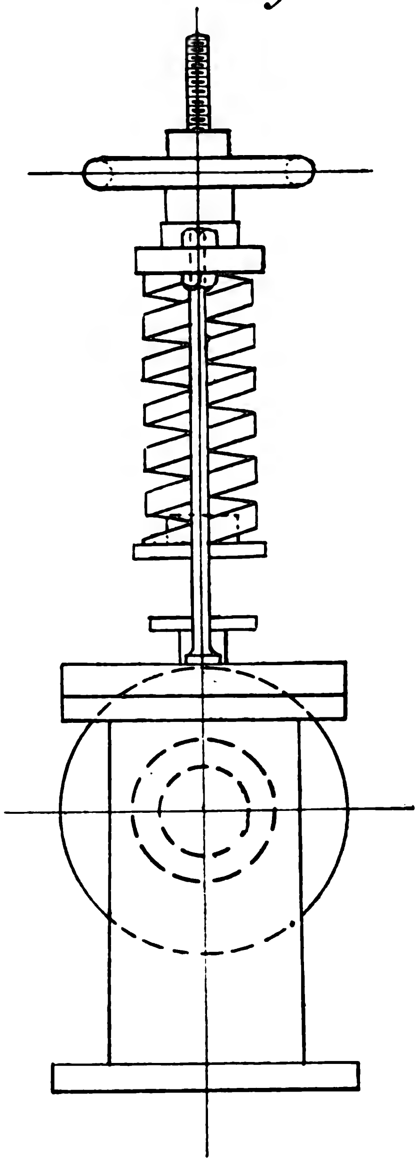


before he can get at the valve the damage done is enormous. The automatic safety stop valve comes in here again, and at the first revolution above the normal, the valve shuts and the engine can only travel with its own impetus, thus reducing damage to a minimum. What if the engine took a race? some might say, it would do the same; exactly, but in that case, owing to a small bye-pass, when the engine assumed its normal speed the valve would open again.

The arrangement of the valve is seen from Figs. 1 and 2, but a brief description will assist to make matters clear. The patent consists of an inverted valve [illegible] a spring, the main valve sliding easi' [illegible] ndle of the smaller or lower valve. A small hole (or bye-pass) is in the side of the main valve, and comes through the collar which forms part of the top of the valve. The spring is set so that its pressure added to the pressure on the top of the valve keeps it full open whilst everything remains at its normal condition, but should the pressure on the engine side fall by reason of the bursting of a pipe or any casualty previously mentioned, the equilibrium is disturbed, and the boiler pressure now being greater than on the top of the valve, it immediately closes.

The only escape of steam now until the valve is shut is through the pass, and in the case of racing, on the engine resuming its former speed, the pressure will soon accumulate and open the valve again.

Fig.2.



Messrs. R. C. Wallace & Co., Queen's Dock, Glasgow, are the sole manufacturers, and the valve has been pronounced by many, well qualified to judge, a complete

success. The leading features are numerous, but we may mention a few. 1st, Perfect safety to life and property, at the bursting of a steam pipe, cylinder, etc., or the breaking of any vital portion of the mechanism. 2nd, Acts as a governor when the engine is racing in a seaway. 3rd, Is very economical as the valve being continually floating admits only sufficient steam to work the engines. 4th, It is not affected by any alteration in the boiler pressure.

Of course, though we have only mentioned the valves, suitability for marine work, still it is equally useful for land work, and a special land valve is made with very slight alterations. Considering the cheapness at which this excellent steam fitting is placed on the market, in fact very little over the cost of the ordinary stop valve, we do no hesitate in saying it commands success.

THE INSTITUTE OF MARINE ENGINEERS.

THE Institute of Marine Engineers has again given evidence of the thorough manner in which its affairs are conducted, in the very enjoyable annual conversazione which was held at the Town Hall, Stratford, on Friday evening, December 8th, which was carried out in a manner worthy the occasion. It matters not whether the members are discussing subjects relating to their profession, or entertaining their friends, the same characteristic of thoroughness and success marks their proceedings. On the above occasion the approaches and the interior of the hall were decorated with handsome foliage plants and extremely pretty fairy lamps, whilst a large collection of exhibits were arranged on the tables. The large banner of the Institute, with the Union Jack and Royal Standard graced the entrance to the large hall. The following were among the exhibits ;—

A model of the paddle-steamer *London Belle*, the latest addition to the fleet of the London, Woolwich & Clacton Steamboat Co. Samples of lubricating oils, lent by Messrs. W. B. Dick & Co. A number of specimens exhibited by the London Asbestos Co., Limited. Samples of metallic packing, by Messrs. James Walker & Co., of Shadwell, and Messrs. Melsom & Griffiths. A model engine, by C. R. Wymer, jun. Binko's automatic speaking tube, shown by H. Binko & Co., Leadenhall Street. Specimens of brass and copper work, by Messrs. Blundell. Some very interesting demonstrations were given by Dr. Hermann Hoffert, of the Royal College of Science, South Kensington, with Anderton's new stereoscopic lantern, during which he illustrated the effect of polarised light or objects thrown on the screen. Experiments were also performed on "surface tension and bubbes," as devised by Professor Vernon Boys, which were extremely interesting. The remainder of the exhibits were as follows :—

Model small steam engine and wooden model of marine boiler with special arrangement of flues, by Mr. N. S. Hawkes ; Axiom lubricator and 80-pressure gauge, W. D. Brown ; moving picture models showing valve gear, D. Joy ; steel plate engraving launch E. I. Co.'s Edinburgh, J. Fell Redman ; model web-bottomed ship (patent), E. F. Wailes ; patent piston packings (Buckley's), 6 in. and 12 in., W. Buckley ; model reversible screw propeller (McGlasson's), R. McGlasson ; reducing valve patent, Messrs. Blundell & Co.'s Brass Works ; art exhibits and plants, W. Dick & Co. ; model Trevithick's road engine and patent safety lamp, G. W. Manuel ; valves and testing apparatus (Dewrance & Co.), Messrs. Dewrance ; models, steam engines, and boilers, F. W. Wymer ; models, dock stanchions (Ovens' patent), D. Ovens ; engine packing and model patent water circulator, C. L. E. Melsom ; asbestos exhibits (showing raw material), United Asbestos Co. ; patent seed cleaner and heaver (picture), J. F. Halkett (Glengall Ironworks) ; model automatic and instantaneous water circulator, G. B. Shepherd ; patent lubricators, ditto tube stoppers, and ditto expander, W. Boaz ; microscope and stereoscope, J. Slight ; model Whitehead and Pollock's piston and ditto of receiver (zinc), since presented to the Institute, P. Devlin ; case Lion packing (metallic), R. Mahany ; framed picture, engine and boilers (s.s. Duchess of Edinburgh), since presented to the Institute, F. Beckett ; model Ruthven's rudder and steering gear, J. R. Ruthven ; Aspinall's marine governor, J. G. Martin ; model glass boiler showing circulation, A. Holford ; model engine, J. Stewart.

Among those of the executive officials of the Institute present during the evening were : Mr. W. H. White, C.B., F.R.S., LL.D. (President of the Institute), and Mrs. White, Mr. A. Beldam and Mr. G. W. Manuel (past Presidents), Professor C. Elliott (president of the local centre at Cardiff) and Mrs. Elliott, Alderman Kidd (ex-mayor of West Ham) and Mrs. Kidd, Mr. R. Leslie (hon. treas.), and Mr. James Adamson (hon. sec.), and the following members of the Council :—Messrs. J. Blelloch, D. Brown, L. P. Coubro, W. J. Craig, J. G. Hawthorn, J. G. Latta, J. Nicoll, J. R. Ruthven, S. C. Sage, F. W. Shorey, J. H. Thomson, and White ; Mr. C. G. Newby (sec. of the Council), and Mr. John Neeley (hon. solicitor).

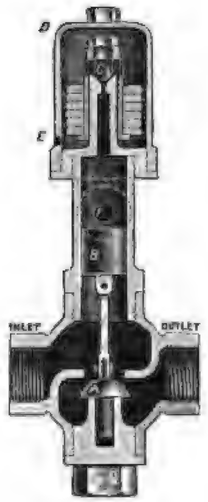
The proceedings commenced with a concert and entertainment, which was attended by a considerable number of ladies and gentlemen. We gave the programme in our last issue, therefore it is unnecessary to give it again in detail, but it will be only just to say that it was much enjoyed and appreciated by the audience.

On the conclusion of the concert, a most enjoyable dance took place, to the music of Mr. T. Bidgood's quadrille band. The programme consisted of 19 items. The managing Committee consisted of the following gentlemen :—Messrs. J. Adamson, D. Brown, L. P. Coubro, A. C. Campbell, J. D. Churchill, W. J. Craig, J. M. Gray, J. G. Latta, R. Leslie, T. G. Martin, C. L. E. Melsom, C. G. Newby, J. Nicoll, W. G. Newall, J. W. Richardson, F. W. Shorey, S. C. Sage, W. J. Taylor, J. H. Thomson, and W. White, together with Mr. A. W. Robertson as convener.

It was a matter of much regret that Mr. A. W. Robertson, convener of the committee, was unable to be present to witness the successful issue that crowned the efforts of himself and his committee. The President and Mrs. White expressed themselves as being highly gratified with the arrangements made, in which we most cheerfully join, and we hope that the Institute may hold similarly successful evenings in the future.

THE "NORRIS" REDUCING VALVE.

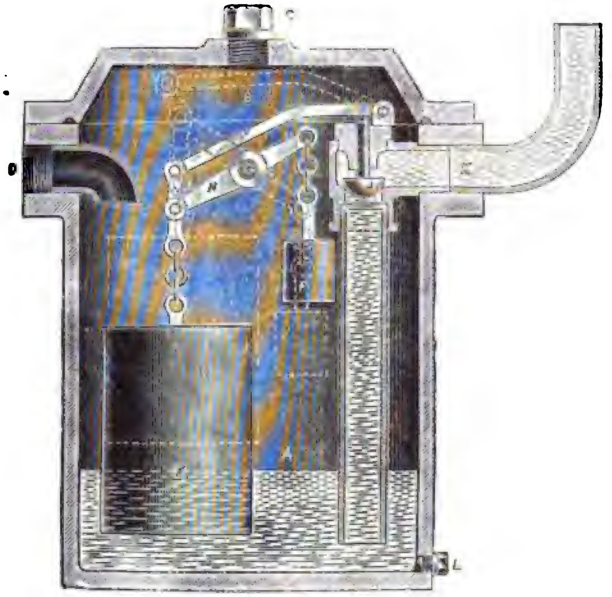
THROUGH the kindness of Mr. W. F. Snowdon, of 32, Side, Newcastle-on-Tyne, we are enabled to place before our readers some particulars of the "Norris" reducing valve, together with an illustration.



The principal advantages claimed for this speciality are, that it has a "full-way valve," is simple and sensitive in action, can be examined and cleaned without the necessity of breaking pipe-joints, and having no liability to friction, has consequently

no wearing parts. The action of the valve may be described as follows:—When steam is turned on it raises the piston *b*, which closes the valve *c*; a portion of steam then passes the piston *b*, until the escape valve *c* blows, the pressure to which this valve is set, being the reduced pressure. The valve *a* will then open sufficiently to allow the necessary amount of steam to pass at the reduced pressure. No matter how the boiler pressure, or consumption of steam may vary, an absolutely reduced pressure will be maintained. The reducing valve is manufactured in sizes of from ½ in. to 6 in. To examine or clean the valve, all that is necessary is to unscrew the plug *g*.

Another speciality of which the same gentleman has sent us particulars, and of which we also give an illus-



tration, is the "Manchester" Steam Trap. This has a "full-way valve" and solid float. Through the valve being placed on the outlet side, fouling is reduced to a minimum. It is claimed for this, that it is the cheapest and most efficient "lifting" trap in the market, and its action is described as follows:—In the top of the box *a* (which is covered by the lid *b*, is placed an automatic air valve *c*. The inlet *d* is coupled to the pipe or apparatus to be drained, and the water of condensation entering the box, causes the float *e* to ascend, being counterbalanced by the weight *f*. The float and weight are mounted upon the stud *g* by means of a lever *h*, which lever, acting upon the valve *j*, the water is ejected at the outlet *k*. The speciality is manufactured in various sizes, with or without "brass union." Mr. Snowdon is the agent for the sale of both these specialities in Newcastle and district, and as they are both cheap and effective, there is little doubt that they will soon be brought largely into use.

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f Address.—Mr. Albert E. Mallandain, Photographic ufacturer, Draughtsman, Lithographer, &c., late of ltry, has removed to more commodious premises at e, E.C.

BOILER FEED PUMPS OF S.Y. "VALIANT."

ON page 421 we illustrate a pair of direct-acting pumps supplied to Messrs. Laird Brothers, Birkenhead, by Messrs. G. & J. Weir, Holm Foundry, Cathcart, for W. K. Vanderbilt's steam yacht *Valiant*. These pumps embody this firm's latest design of this specialty; and by their new arrangement of the water valve chest, the valves are easily accessible, and can be examined independently of each other, an advantage which every engineer appreciates. The diameter of the pumps is 10 in. by 21 in. stroke, and they are arranged to work in conjunction with the Weir Feed Heater in the usual manner. The water valves are of the group type in gunmetal seats, and are all interchangeable and afford a large water area with a small lift. The valve motion of each cylinder is derived from its own piston rod, and each pump is capable of dealing with the entire feed-water. The pumps are compact and neat in design, and are thoroughly in keeping with the high character of the other fittings in the S.Y. *Valiant*.

THE NEW TORPEDO BOAT CATCHER "HAVOCK."

IN view of the present agitation in the country for an increase of our naval power, and above all for an increased means to cope with the large preponderance of torpedo boats possessed by other naval powers, Messrs. Yarrow & Co. are the heroes of the hour with their new and successful torpedo boat catcher, the *Havock*.

We had great pleasure in attending a show trial of the boat upon the Thames on December 2nd, from Gravesend to the Mouse Lightship, and found the performance of the boat all that could be desired, and enthusiastically admired by a large company of experts and representatives of foreign States.

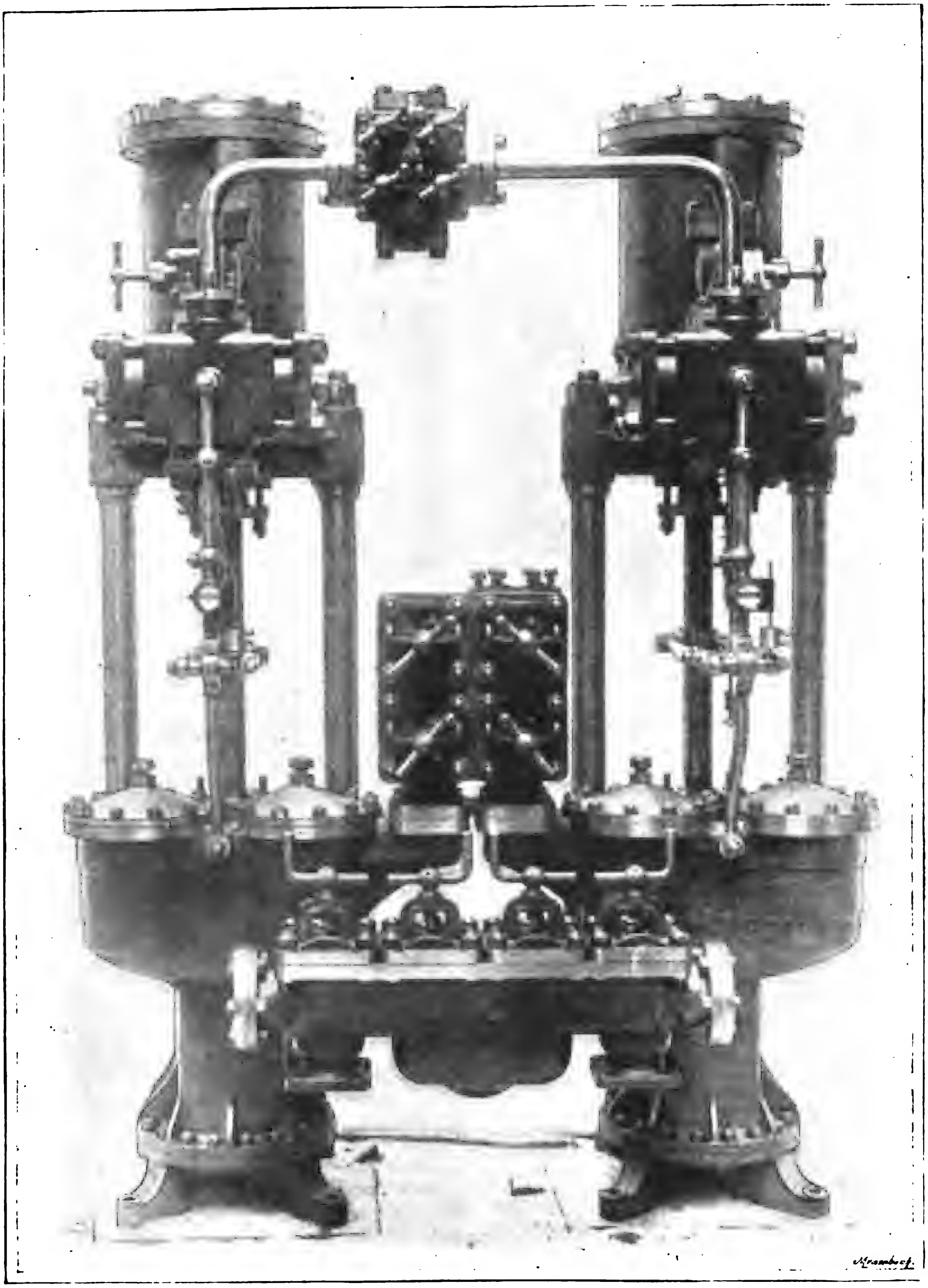
This trip was not to test maximum speed or consumption, as these had been already successfully carried out to the satisfaction of the Admiralty, to whose order she had been built, the *Havock* in those trials, under the adverse circumstances of a boisterous sea, having developed a mean speed of nearly 27 knots per hour. It had also before been proved that she would steam at 10 knots with a consumption of 3½ cwt., and could thus cover 3,500 knots at that speed without re-coaling.

In very pleasant, though sharp weather, the *Havock* got under way from Gravesend with the greatest ease and celerity, and proceeded down the Reach under easy speed until clear of the shipping, but afterwards increased her speed to about 21 knots without any apparent distress and with far less vibration than might have been expected. We ascertained that throughout the day there were no trouble with heated bearings or otherwise, and the boilers were evidently steaming well within their power and without any priming.

When at the Mouse Lightship the boat was put through circle sailing with hand steering gear only, and the radius of the circles were remarkably small for her length, though not pushed to the smallest extent, such as had been before attained with the steam steering gear. Her handiness in manœuvring was however fully exemplified, and she appeared able to go anywhere and to do anything.

We have in a former issue given all details of her dimensions, and seeing the immense amount of machinery that has been packed within her hull, the remaining space for the accommodation of the officers and crew of 42 men has been wonderfully and not uncomfortably utilised.

Her armament of one 12-pounder quick-firing gun, placed on the forward conning tower, and two similar 6-pounder guns, one on either side of the conning tower, together with three 18-in. torpedo tubes, one in the stem for firing ahead, and two swivelling abaft for firing over her quarters, make the *Havock* both a torpedo boat catcher, which ought to be able to account for any number of torpedo boats, and also a torpedo boat herself as regards her power of offence against ironclads.



Boiler Feed Pumps. (See page 420).

The official trials have attained such a marked success that the Admiralty have since ordered no less than thirteen similar vessels, to be constructed by various makers, which ought to place the British Navy in a much more favourable position as regards torpedo offence, or as regards the power to cope with torpedo boat attack by an enemy.

After a very pleasant trip the *Havock* disembarked her company at Blackwall, and went back to Messrs. Yarrow's yard preparatory to being put in commission at Portsmouth.

THE SOCIETY OF ENGINEERS.

(*From the "Times" of December 14th.*)

THE annual dinner of the Society of Engineers was held at the Holborn Restaurant, on December 13th, Mr. W. A. M'Intosh Valon presiding. Those present included Sir Robert Rawlinson (Vice-President of the Institution of Civil Engineers), Mr. W. H. White, C.B. (Director of Naval Construction), Mr. G. A. Goodwin (the President elect), Mr. Henry Faija and Mr. W. G. Pierce (Vice-Presidents), Mr. J. Bernays, Mr. Charles Gandon, Mr. Perry F. Nursey, Professor H. Robinson, Mr. A. T. Walmisley, and Mr. J. W. Wilson, jun. (Past-Presidents), Mr. S. H. Cox and Mr. G. M. Lawford (members of Council), Mr. A. Williams (Hon. Secretary and Treasurer), Mr. Samuel Wood (Hon. Auditor), and Mr. G. A. Pryce Cuxson, the Secretary of the Society. After the usual loyal toasts, the President proposed "The Navy, Army, and Auxiliary Forces." Mr. W. H. White, in responding, remarked that greater demands were made on the officers and men of the Navy now than at any previous time. In the days which ended with the great French war the condition of the material of the Navy was practically the same as it had been for 200 years. The officers and men had to deal with ships of practically the same size as had been built 200 years before; the armaments were similar; there was no complicated mechanism; and although there was no lack of seamanship and gallantry, everything could be worked by experience and precedent. Now, however, officers and men were called upon to deal with engines of war which were inevitably complicated and difficult to understand, and not easy to manage under the conditions of actual warfare. But when it was remembered that every year now in the summer, sometimes at very short notice, 40 or 50 ships were gathered together, a large proportion of which had been officered and manned and sent to sea in three days, and were safely handled and manœuvred in mimic warfare without any accident of any serious character, he maintained that there was no greater proof of the efficiency of the Navy. It was most astonishing to see the manner in which the officers and men, placed in a strange position, and dealing with ships they had in many cases never seen before, had settled down and seemed quite at home. The training and ability and *personnel* of the present day gave us an advantage over any country in the world which it was not easy to overestimate. Of course, every one at the present moment was thinking of a subject on which he himself could say no word—the demand for an increase of the Navy. He could, however, say this—that it was not just or right in dealing with the future to forget the past, and the immediate past. He had been Director of Naval Construction now for more than eight years, and during that time the expenditure on new construction (exclusive of armaments), with which he had had to do, had exceeded 30 millions sterling. He had not the least doubt that whatever demands were made by the country on the great shipbuilding industries would be met by them. In recent years programmes which were declared at the time to be impossible had been successfully carried out, and in the same way, whatever demands were made in the immediate future, the great industrial resources of this country would be found to carry them out. Just as he claimed for the *personnel* of the Navy capacities which, without boasting, he thought were unrivalled, so it was matter of common knowledge and of definite certainty that the shipbuilding and engineering resources of this country were unmatched, and, if utilised, must make us abundantly safe. Other toasts followed.

Messrs. John Scott and Co., of Kinghorn, have received two small orders—one for a Spanish firm for a 1,650-ton deadweight steamer, and one for a ferry steamer for service between Liverpool and Birkenhead, to carry about 1,200 passengers, and be about 700 tons measurement.

CHURCH'S IMPROVED DESIGN OF STEAM ENGINE.

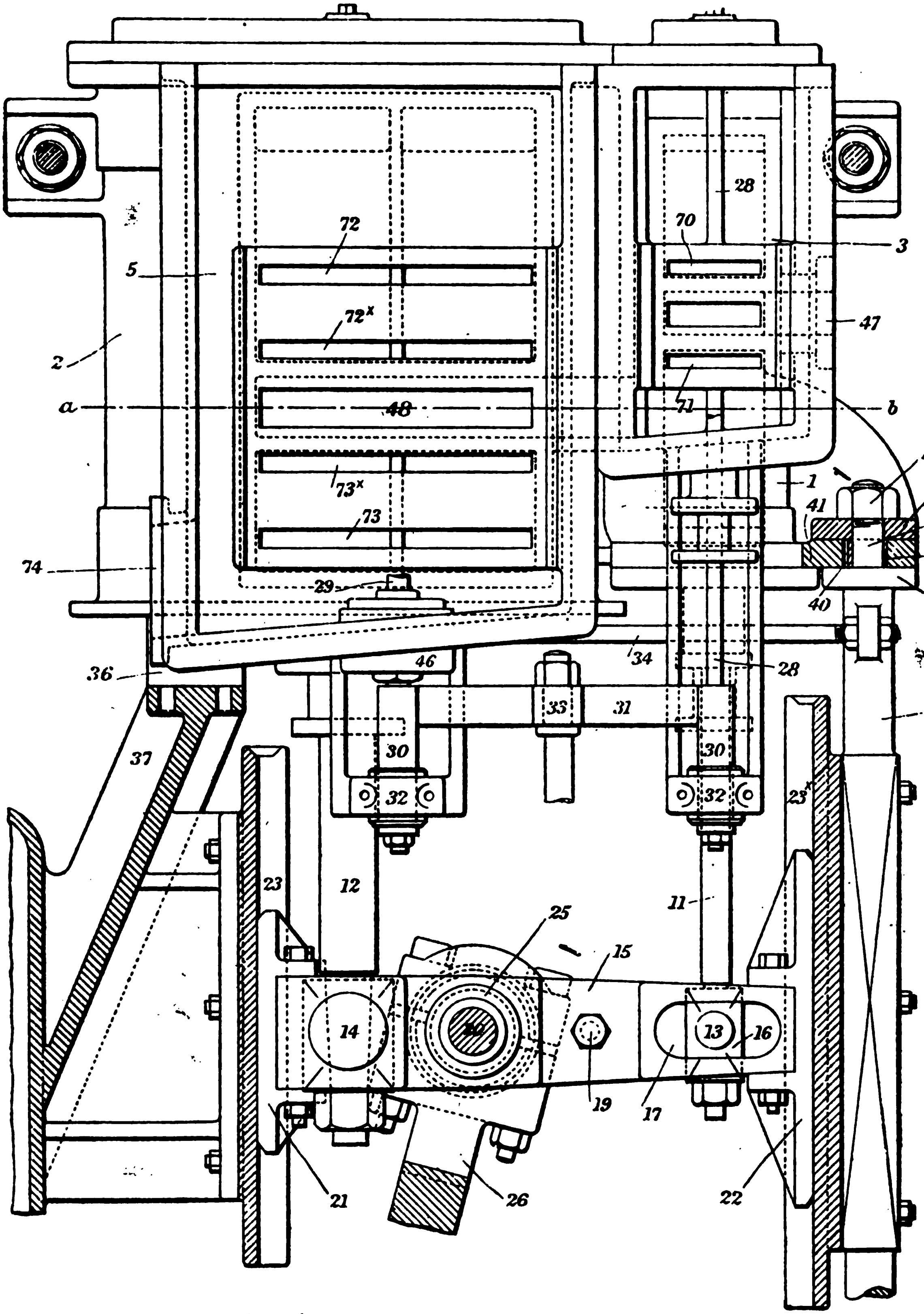
IN the adjoining diagrams we illustrate a novel design of compound steam engine, which has been invented by Mr. W. C. Church, of Brixton. The inventor claims that great steadiness in the movement of the working parts is ensured, friction is reduced, and economy of motive fluid, and increased power is obtained. In referring to the diagrams, Fig. 1 represents a part sectional elevation of a compound high and low-pressure engine, the covers of the valve chests being removed. Fig. 2 is a part plan and a part horizontal section, taken on the line *a b* figures 1 and 4.

Fig. 3 is a vertical section of the high-pressure cylinder and its valve chest on the line *c d* Fig. 2. Fig. 4 is a vertical section of the low-pressure cylinder and its valve chest taken on the line *e f* Fig. 2, and Fig. 3 is a horizontal section of the cross head. The various portions are identified by reference numerals. The high-pressure cylinder 1 and low-pressure cylinder 2 are arranged side by side parallel to one another.

The low-pressure cylinder is of such considerably greater diameter than the high-pressure cylinder as to utilise, as far as practicable, the pressure of the steam which passes directly into it from the high-pressure cylinder. For example, in the engine illustrated the diameter of the low-pressure cylinder is four times that of the diameter of the high-pressure cylinder, and consequently about sixteen times the area, the boiler pressure being presumed to be 215 lbs. per square inch. When the engine is making 60 revolutions per minute, the steam occupies only about one second in passing through both cylinders to the atmosphere or condenser, as the case may be, and therefore loss by condensation is greatly reduced; 3 is the chest or casing containing the high-pressure slide valve 4, and 5 is the chest or casing containing the valve 6 of the lower-pressure cylinder. These valve chests or casings are cast in one with the cylinders, and are provided with covers 7 and 8. The pistons 9 and 10 of the high and low-pressure cylinder are connected by their rods 11 and 12 to gudgeons 13 and 14, mounted in a crosshead, 15. The trunnions of the high-pressure piston rod are fitted into blocks 16, which can slide in slots 17 in the crosshead to prevent any undue lateral strain on the piston-rod or rods, by the expansion and contraction of the cylinders. This crosshead consists of two sides or cheeks 18 connected together between their opposite ends by bolts 19 and 20, and also at their ends by slippers 21, 22, which constitute the guiding surfaces to slide in the guides 23, 23*, distance pieces 24 being interposed between the sides or cheeks 18 to maintain them at the required distance apart, shown in Figs. 1 and 5.

The bolt 20 passes through bosses 25, formed on the sides or cheeks 18 of the crosshead, which bosses constitute the journals to which the forked end of the connecting rod 26 is connected. This bolt 20 may be prolonged in either or both directions, and be utilised for driving pumps or the like. The positions of the journals, with reference to the points of connections of the piston-rods to the crosshead, are arranged according to the difference in the comparative diameters of the cylinders and also to the differences of pressures exerted on the pistons, so that when the

Fig. 1.



Church's Improved Design of Steam Engine. (See page 422).

FIG. 2.

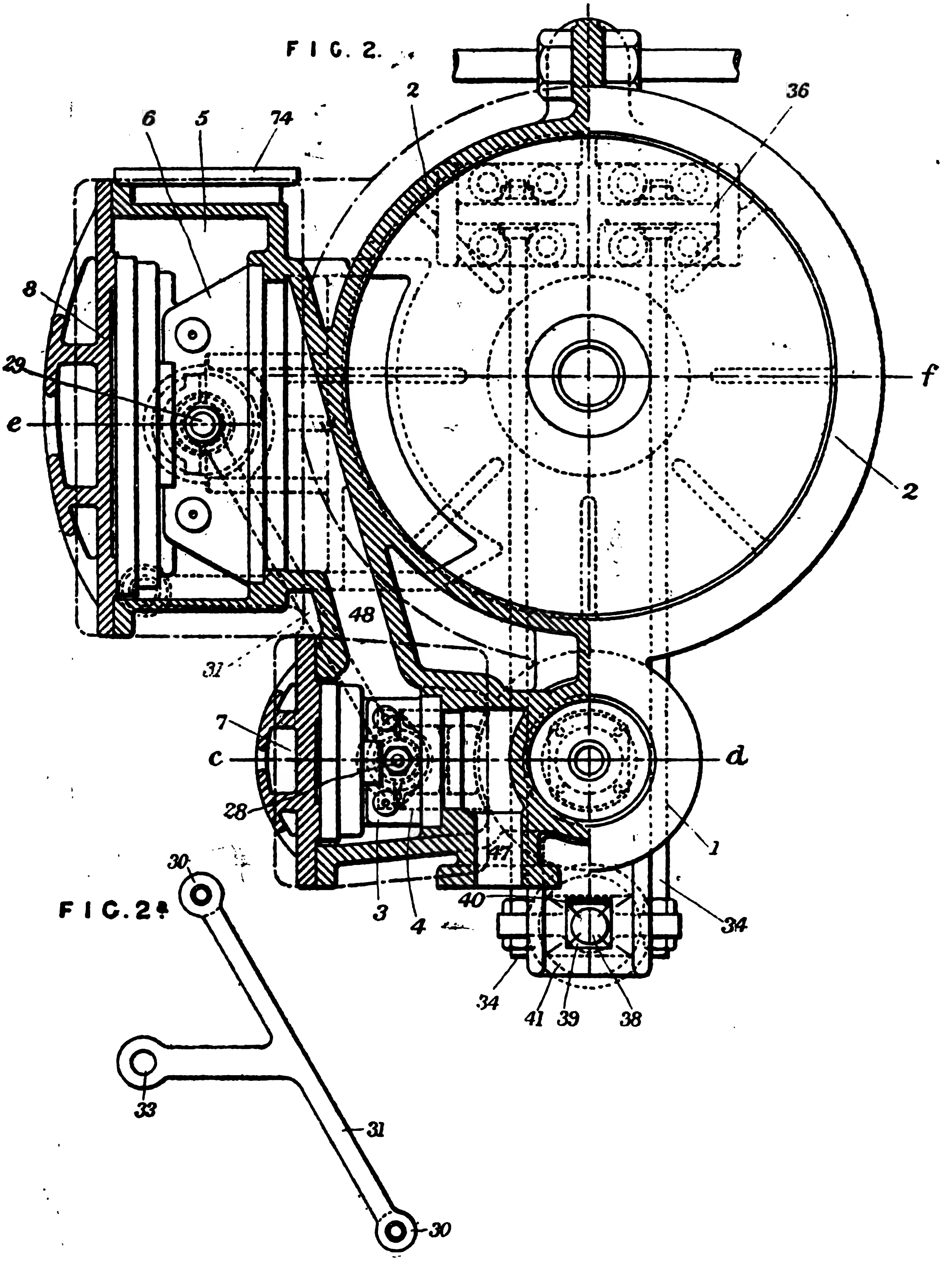
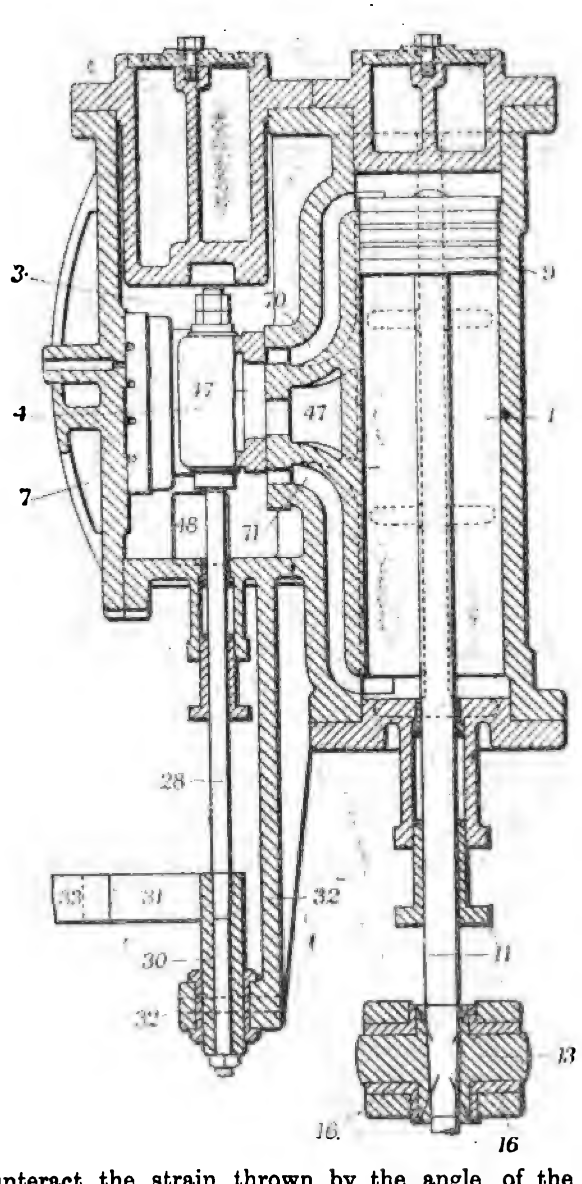


FIG. 2a

IMPROVED DESIGN OF STEAM ENGINE. (See page 422.)

crank is at a quarter stroke, that is, at right angles to the line of motion of the pistons, and the connecting-rod is at its greatest angle, as shown in Fig. 1, the leverage between the journals or trunnions 25 and the centre of the low or lower-pressure piston-rod 12 is such as to give greater power on that end of the crosshead, and, according to the inventor's idea, thereby

FIG. 3.



counteract the strain thrown by the angle of the connecting-rod on the slipper 21 against the guide 23 at that end of the crosshead when the pistons are making their inward strokes. If the crank is arranged to turn in the opposite direction to that described it is obvious that the positions of the piston-rods with reference to the journals or trunnions 25 will be reversed. The length of the slippers 21, 22 will be governed by the difference of power exerted on the crosshead on opposite sides of the journals or trunnions 25, the length of the slippers being increased according to the excess of power exerted on one end of the crosshead over that exerted on the opposite end thereof, to act as leverage to maintain the crosshead in position at about right angles to the piston-rod, and thereby reduce the friction between the slippers and their guides and give increased power to the engine.

It is, therefore obvious, according to the inventor, that a shorter connecting rod can be used than heretofore, without loss of power by increased friction on the slippers and their guides, for the reasons that when the piston commences its inward stroke, that end of the low pressure slipper 22 which is nearest to the crank, and that end of the high pressure slipper 22 which is furthest from the crank, are caused to bear against their guides with greater pressure than at their opposite ends, which opposite ends are slightly removed from their guides, and will allow lubricant to pass between the slipper 21 and its guide. When the piston commences its outward stroke this is reversed, that end of the slipper 21 which is furthest from the crank, and that end of the slipper 22 which is nearest the crank, being caused to bear against their guides with greater pressure than at their opposite ends, which opposite ends are slightly removed from their guides, and will admit of lubricant passing between the slipper 22 and its guide. The slippers and their guides are thus maintained thoroughly lubricated.

To prevent the distance between the working faces of the guides 23, 23* from being affected by the expansion and contraction of the cylinders, I connect by the bolts or rods 34 (*see* Figs. 1 and 2) the column or frame 35 to which the guide 23* is attached to a foot 36 to which the framing or column 37 carrying the other guide 23 is attached. The column, 35, is provided with a stud 38, which passes through a block 39 fitted in a slot 40 formed in a lug or bracket 41 on the high-pressure cylinder, which block 39 forms a distance piece, on which a plate or washer 42 is forced by a nut 43 or otherwise (by a collar, for example), so as to allow freedom for the movement of the lug 41 between the plate or washer 42 and a flange or cottar 44 on the column or frame 35 to allow the cylinders to expand and contract under changes of temperature without affecting the position of the guides 23, 23*.

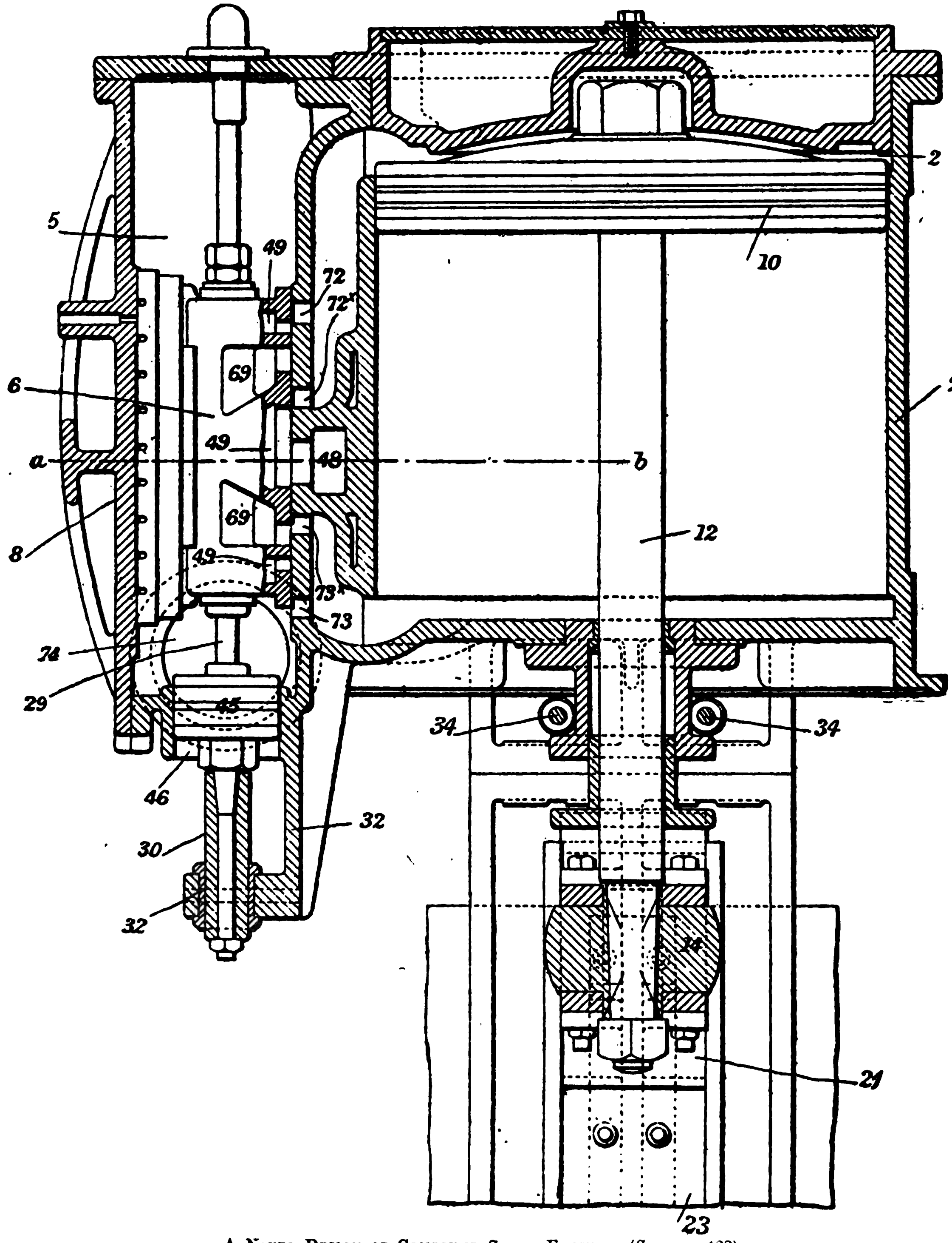
The spindles 28 and 29 of the valves 4 and 6 are connected to sleeves or arms 30 formed on the opposite ends of a crosshead 31, shown detached in Fig. 2A, which sleeves or arms are fitted to slide in guides 32, shown in Figs. 1, 3, and 4, as being cast on the valve boxes 3 and 5, but which may be attached thereto or to any other suitable part of the engine. This crosshead is connected at 33 to the mechanism by which the valves are worked, and may be made in one piece, as shown in Fig. 2A.

When the cylinders 1 and 2 of a condensing engine are arranged above or below the crank (in Figs. 1 to 4 of the drawings I have shown them arranged above the crank) I balance the weight of the slide valve 6 of the low pressure cylinder by means of a piston 45 fixed on the spindle 29 of the said valve 6, and working in a cylinder 46 which may be cast in one with the valve chest or case 5, as shown in Fig. 4, or which may be made separate therefrom, and be connected thereto in any suitable manner. One end of this cylinder is open

to the interior of the valve chest whilst the opposite end is open to the atmosphere, so that as the pressure in the valve chest 5, and consequently on the inner

slide valve. Steam from the boilers is admitted by the passage 47, Figs. 1, 2 and 3, and enters the cavity 47* in the high-pressure valve 4, whilst the exhaust steam

F I G. 4.



A Novel Design of Compound Steam Engine. *(See page 422)*

face of the piston 45, is below the atmospheric pressure acting on the outer face of the piston, the excess of the [illegible]ric pressure serves to sustain the weight of the

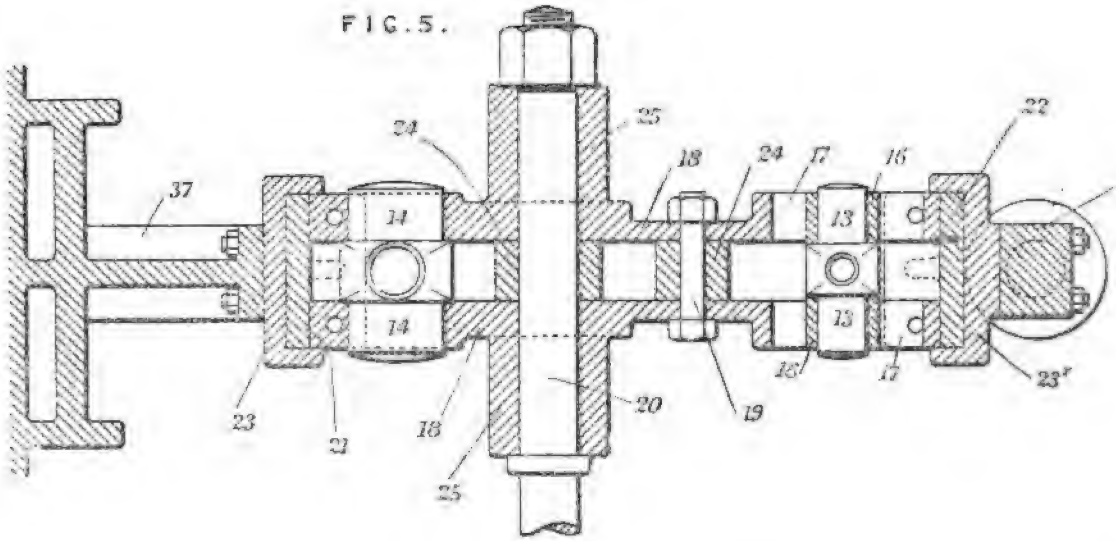
from the valve chest 3 passes by a passage 48 (shown clearly in Fig. 2) into the cavity or cavities 49 in the valve 6 of the lower pressure cylinder 2 (see Fig. 4).

The internal capacity of the high-pressure valve and cap forms the high pressure steam chest, and the internal area of the cap is greater than the area of the valve face in contact with the port face of the cylinder, so that the pressure tending to keep the valve to the port face of the cylinder is greater than the pressure tending to force it from the said port face, and thereby its tightness is ensured.

The engine works as follows:—The pistons 9 and 10 being at the end of their inward or top stroke, and the valves 4 and 6 just opening to admit steam to the back or top sides of the pistons, as shown in Figs. 3 and 4, and moving in the reverse direction to that of the pistons at this period of the stroke, live steam admitted at 47 enters the cavity 47* of the valve 4, and passes by the port or passage 70 to the top or inner end of the cylinder 1, and acting on the piston 9 drives it towards the opposite or back end of the cylinder, the exhaust steam from the opposite side of the piston passing out of the cylinder by the port or passage 71 into the valve chest or casing 3, and out therefrom by the passage 48 into the cavity or cavities 49 of the valve 6 of the lower pressure cylinder 2. The valve 6 is a double-ported valve, and the ports 72, 72*, as shown, are just opening to admit the exhaust steam passing from the valve chest or casing 3 to the top or back of the piston 10 to drive the piston towards the outer or downward end of the cylinder 2. As the area of the piston 10 is considerably greater than the area of the high-pressure piston 9, the whole or nearly the whole of the pressure is taken by the outward or downward movement of the piston 10 from the valve chest or casing 3 passage 48 and the interior cavity of the valve 6, and at the same time the pressure is removed from the back of the high-pressure piston 9 and also from the high-pressure valve rod or spindle 28.

The exhaust steam from the opposite side of the piston 10 passes by the ports 73, 73* into the valve chest or casing 5, and out therefrom to the atmosphere, or to a condenser by the pipe or passage 74. If the exhaust steam from the casing 5 passes to the atmosphere, the pressure on the valve spindle will only be momentary, but if it passes to a condenser, the valve spindle will be in a vacuum. The same operations as those described will take place when the valves are reversed to admit steam to the opposite sides of the pistons, the steam from the high-pressure valve chest 3 passing then through the passage 48 as before into the cavity of the valve 6, and therefrom through the ports 73, 73* into the cylinder 2, the exhaust steam from this cylinder passing through the ports 72 72* into the valve chest 5, and thence through the pipe or passage 74 into the atmosphere or into a condenser as before.

FIG. 5.



HULL AND DISTRICT INSTITUTION OF ENGINEERS AND NAVAL ARCHITECTS

THE usual monthly meeting of the members of this Institution was held on Monday evening, December 4th, the President, J. Spear, Esq., in the chair, when Mr. J. C. Simpson (Boiler Insurance and Steam Power Co.) read a paper on "Incrustation in Steam Boilers."

In the course of his paper Mr. Simpson stated, that one of the most troublesome problems that steam users in this district have to contend with is feed-water for their boilers, as nearly all the water available is more or less heavily charged with lime and magnesium salts, which cause formations of scale and deposits of sludge.

Some of the water at present used is almost totally unfit for boiler purposes, and the analysis of a quantity from one particular, in Hull gives the enormous proportion of 745 grains of solid matter per gallon, and in addition 365 grains of chlorine (in suspension and dissolved), this latter being equal to 603 grains of common salt.

If a boiler using this supply were to be neglected, and not continually blown off and cleaned, serious trouble would very quickly result, as in a Lancashire boiler evaporating say, 20,000 gallons per week, the deposit left would in a week amount to close upon 1 ton, or sufficient in one month to cover 800 square feet of boiler surface with a thickness of scale equal to 13-16th of an inch.

After dealing very fully with the various sources of supply and giving analyses, the lecturer went thoroughly into the question of the best way to get rid of the various impurities, salts, &c., by means of boiler compositions, constant use of the blow-off taps, &c., and in conclusion said that, speaking generally, if the following three simple rules were attended to, less trouble would be experienced with incrustation in steam boilers.

1st. The blow-off tap to be opened first thing in the morning and again on starting after stoppage at each meal, for twenty seconds at a time.

2nd. That a suitable fluid be put in regularly with the feed-water.

3rd. When the time comes round for boiler cleaning, that the water be kept in after the steam is blown out, the dampers opened, and the brickwork allowed to cool for thirty-six hours if practicable, then the water run off and men go in as soon as possible and scrape the plates and wash out.

Numerous examples were given during the evening of the various defects caused by corrosion and samples of scale (some nearly 2 in. thick) were exhibited, as also samples of water treated with various compositions, &c.

At the close of an interesting discussion, a hearty vote of thanks was accorded Mr. Simpson for his valuable paper.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our own Correspondent.)

The Naval Agitation.

During the month of December the movement in favour of an increased navy, which was predicted in these columns as far back as last September, has grown in volume and strength. From the moment when Mr. Gladstone most gratuitously stated that the navy was already sufficient for its work, an impetus was given to the agitation such as might otherwise have been lacking. That our fleet is far from being strong enough, or numerous enough, to fulfil all the calls that a war, say against France and Russia combined, would make upon it, is well-known to men of all shades of political opinion. Therefore it is that the curious spectacle has been seen of men like Mr. Arnold-Foster and Sir E. Ashmead Bartlett, along with Mr. W. Allan and Mr. T. P. O'Connor, working in agreement towards a common end:— that British naval supremacy must be maintained. A great meeting, convened by the London Chamber of Commerce, also on a non-political basis, passed a series of resolutions supporting in principle the same demand, and there can be no question that the Government, if it saw the way to meet the cost, would be perfectly ready to comply with the country's wishes. Unfortunately, the matter was dragged into the arena of party politics by a few self-seeking place-men and unpatriotic journalists, who apparently thought that under cover of pretended apprehension for the Imperial security they might with safety make an attack upon their political opponents. Such a scheme failed as it deserved to do, and the marvel will be if in spite of this degradation of a great question, the Navy should still be strengthened, as it must be, if the existence of the Empire is not to be placed in great peril.

The Naval Debate.

Although it is deplorable that a question of such moment to the Empire as our naval efficiency, should be treated as a matter for political partizans to wrangle over, the discussion which took place in the House of Commons on the night of December 19th will not be without its uses. For one thing it was clearly established that there is a body of men in the House of Commons who are disposed to look at this question from a higher standpoint than that effected by the bodies of either party; this party may be small, but its leader, Sir Charles Dilke, is a tower of strength and his speech was magnificent. It cannot fail to tell with the country. For another, it is evident that neither Mr. Gladstone nor Sir William Harcourt thoroughly realise the danger of the situation, much less take that amount of interest in the matter which as the responsible Ministers of the Crown they should do. The Chancellor of the Exchequer asserted that the supremacy of the Navy is for the moment absolute, but his calculations are based merely upon a partial estimate of the relative forces which could be arranged on either side and are therefore entirely misleading. According to Mr. Gladstone, if we laid down no new battleships in the interval, we should still in 1897 be superior to France and Russia combined in displacement, although inferior in eight ships in numbers, but this again is misleading, because, as all experts assert, it is superiority and ¬ality we must aim at, and no one believes that if we delay the commencement of future ships until the end of 1894 we shall get sixteen battleships completed by 1897. We may now be able to build faster than foreigners can, but who shall be bold enough to say that they will not compete with us in this respect also before long.

A Forecast.

It is probable that, although Ministers have refused, at the bidding of their opponents, to divulge their programme of future shipbuilding, still, the outcry which has been raised can scarcely be without its effect on their policy. The Admiralty officials are known to have prepared a scheme of construction, and it is possible to make some kind of a guess as to what this is like. It has been rumoured that Government will propose to spend for three years annually the sum of £1,500,000 as additional to ordinary expenditure on new construction, which would thus amount to about £4,000,000 a year, or a total of £12,000,000 for the years 1894-5-6-7. For this sum we might have twelve ships of an improved *Centurion* class, costing altogether about £7,500,000, and all of which might be ready for sea in less than three years. It would be far better to have twelve ships all precisely alike than a smaller number of different types. It is also more economical to turn out similar ships. Ten cruisers of the *Minerva* type, costing £2,500,000, would afford additional protection for commerce. Another million would give us thirty torpedo-boat destroyers, and there would be yet a million left with which to provide for the *Terrible*, and to give additional features to the above vessels over and above the cost of their prototypes. This is not to be compared with the programme suggested by Lord Charles Beresford, but it would certainly give us a large number of useful and effective vessels with celerity and dispatch. If Lord George Hamilton is correct in his calculations, it is in the year 1896 that, unless adequate preparations are made in the meantime, we shall find our maritime superiority in jeopardy. Our aim, therefore, should be to get the largest possible number of line-of-battleships completed by that date, and it is pretty certain that this will not be the case if vessels of the *Magnificent* and *Majestic* class are put in hand.

The Shipbuilding Programme, 1893-94.

On December 2nd eight months had elapsed since the programme for 1893-94 was agreed to by the House of Commons. That is to say, just two-thirds of the period had sped by in which that programme was to be forwarded, and it is instructive, in face of the charges of delay and procrastination which has been brought against the administration, to compare performance and promise. The estimated expenditure to March 31st, 1894, is given first in each case, then actual expenditure during eight months of financial year from official sources, and lastly balance to be spent in four months:—*Magnificent*, £179,509, £3,739, £175,770. *Majestic*, £81,912, £2,475, £78,437. *Talbot*, £24,781, £8,265, £16,516. *Eclipse*, £16,734, £13,142, £3,592. *Minerva*, £28,168, £8,676, £19,492. *Powerful*, £57,544 nothing, £57,544. The first keel plates of the *Magnificent* were laid at Chatham on December 12th in No. 7 dock, near where the *Hood* was built, and she will doubtless be a splendid piece of naval architecture when completed, but how the balance of £175,770 is to be spent in the next four months is not very clear. Her engines of 12,000 H.P. will be built by Messrs. Penn, and the boilers will work with Martin's system of induced draught. The expenditure up to date has been principally on steel plates and bars, &c., which will now be worked into the ship. The keel plates of the *Majestic* have not yet been laid, but progress has been made in her case also with the preliminary work of constructing plates and frames, and it is estimated that by the date she can be begun about 1,000 tons of material will be ready. The Naval Construction & Armaments Co., at Barrow, will supply the machinery for this battleship.

Progress of the Cruisers.

The first of the three second-class cruisers to have her keel-plate laid was the *Minerva* at Chatham, on December 4th, in No. 2 dock, from which the *Dryad* had been previously launched. A large quantity of her material had been prepared in advance, and inside of a week the whole length of her keel was laid and a good deal of the lower framing in place. There is no doubt that at least for a time her growth will be rapid, and probably it is desired to point to her as an example of what is being done in new construction; still £19,000 odd is a big sum to get through in four months. The first keel-plate of the *Eclipse*, a sister ship, was laid at Portsmouth on Friday, December 8th.

In the case of this vessel, as in that of the *Minerva* and the *Talbot*, some expenditure had been incurred previously for material and for machinery which is being built in the dockyards. The *Talbot* has not yet been laid down. Tenders have been called for by the Admiralty for the construction of the *Powerful*, whose designs have undergone several alterations since they were originally prepared. She will be a particularly powerful vessel, having a tonnage of 14,200, and a length of 500 ft., with a speed, varying with the draught used, from 22 to 24 knots. The following firms were asked to tender for the construction of the ship and her machinery:—Earle's Co.; Fairfield Co.; Naval Construction and Armaments Co.; Palmer's Shipbuilding Co.; J. & G. Thomson; Laird Bros.; Thames Iron Works; Armstrong, Mitchell & Co.: Harland & Wolff; Greenock Foundry Co.; Humphreys, Tennant & Co.; John Penn & Sons; and Maudslay, Sons & Field.

THE "POWERFUL'S" BOILERS.

It is a most extraordinary and remarkable circumstance that Great Britain should be unable to supply the Admiralty with the boilers required for what is to be the fastest cruiser in the world. The American *Columbia* is at present the record breaker in this respect, the *Powerful* is "to see her and do two knots better." But the British naval authorities want water-tube boilers for the purpose, and because it is said, no English or Scotch type would be suitable, the kind ordered are those of Messrs. Delaunay, Belleville & Co. These tubulous boilers are such as are now being fitted in the gunboat *Sharpshooter*, and they are said to be the only type of water-tube boiler suitable for large vessels. It is most desirable that this point should be cleared up without delay. It is also claimed for these boilers that they possess the following, among other, advantages, over all others:—Higher working pressure can be obtained with them; economy of maintenance; less liability to damage through accident or neglect: in case of damage, celerity in making repair; ease in stopping and starting, running up to high pressure or changing from high to low. The price to be given for these boilers has not been made public, but it should be. The requirements are that work and quality shall be of the highest order. When completed the *Powerful's* continuous sea speed, for smooth water steaming, and with a clean bottom, is to be twenty knots. On an eight hours' natural draught contractors' trial, the speed will be about twenty-two knots, and on a four hours' forced draught trial, a speed of twenty-four knots is expected.

SPECIFICATIONS OF THE "POWERFUL."

To all shipbuilding firms who have been invited to tender for the construction of the machinery for the *Powerful*, the Admiralty have issued the following notice. "Messrs. Maudslay, Sons & Field, London, in their capacity as agents for Messrs. Delaunay, Belleville & Co., of St. Denis, France, require a specific agreement to be entered into by any firm making the Belleville type of boilers. As regards the machinery of the *Powerful* about to be tendered for, you are at liberty, whether you desire or not to avail yourselves of Messrs. Maudslay's proposal, to apply at this office for information as to details or arrangement of the Belleville boilers which are in possession of the Admiralty, sending an accredited representative for that purpose. Your representative will also be permitted, should you so desire, to inspect the boilers of this type which are now being erected on board the *Sharpshooter*, at Devonport."

SHIPS DELIVERED IN 1893.

A very large number of vessels have been delivered from the contractors to the naval authorities during the past year, and at the present time the only war vessels for the British Navy which are being built in private yards are torpedo boat destroyers and torpedo boats. Four battleships have been delivered, the *Ramillies*, built and engined by Messrs. J. & G. Thomson; the *Royal Oak*, built and engined by Messrs. Laird; the *Resolution* and *Revenge*, built and engined by Messrs. Palmer. Messrs. Humphreys, Tennant & Co. provided the engines for the *Empress of India*, built at Pembroke. Four first-class cruisers were also delivered, the *Grafton*, built by the Thames Ironworks Co., and engined by Messrs. Humphreys, Tennant & Co.; the *Endymion* and *St. George*, built and engined by Messrs. Earle; the *Gibraltar*, built and engined by Messrs. Napier. Several gunboats of the old torpedo boat catcher type (Sharpshooters) have been delivered, including the *Onyx* and *Renard* by Messrs. Laird, and the *Speedy* by Messrs. Thorneycroft. The last vessel to be turned over is the *Havock*, torpedo boat destroyer of new type, by Messrs. Yarrow, the forerunner of a numerous progeny which will now be speedily turned out by various makers. The machinery for a number of dockyard built ships has also been supplied during the past year, Messrs. Penn engining the *Crescent*, *Alarm*, *Leda*, and *Circe*; Messrs. Humphreys, Tennant & Co., the *Empress of India* and *Superb*; Messrs. Earle, the *Charybdis*; Messrs. Maudslay, Sons & Field, the *Devastation*; Messrs. Hawthorn, Leslie & Co., the *Cambrian* and *Bonaventure*; Messrs. Thomson, the *Hermione*; the Greenock Foundry Co., the *Centurion* and *Barfleur*; the Naval Construction and Armaments Co., the *Flora*; the Fairfield Co. the *Dryad*; Messrs. Yarrow, the *Antelope*.

PORTSMOUTH DOCKYARD.

There are innumerable *canards* flying about as to improvements to be carried out at this yard in the coming year. It is said that the harbour is to be dredged throughout so as to allow a whole fleet of battleships and cruisers to take shelter in the stream in case of a fog at Spithead. The stoppage of the construction of docks Nos. 14 and 15 for the purpose of altering their design has also been the foundation for a story of new development in this direction. Practically, all that is to be done is to lengthen these docks so that they may be available for larger vessels, and this means that the sheds recently erected will have to come down, as well as taking up and relaying the railroad which runs at the head of the docks. The *Inflexible* has paid off here, and been recommissioned by the crew of the *Nelson* as port guardship, the *Colossus*, *Neptune*, *Devastation*, and *Swiftsure* being also in the port for the purpose of making similar exchanges. The *St. George* has been delivered by Messrs. Earle, and is the last of the first-class cruisers of the Naval Defence Act to come to the dockyards. All the gun-mounting machinery and fittings of the *Centurion* have now been delivered, and there is nothing to delay this ship's completion. The *Resolution* commissioned on December 5th, leaving but three of her sisters here, the *Royal Oak* from Lairds', well advanced; the *Revenge* from Palmer's, not quite ready, but expected to hoist the pennant in January; and the *Repulse*, which has been scarcely touched since she came from Pembroke. It is said that the money which was to have been spent on this ship was spent instead on the *Howe*. The *Fox* is the only cruiser completing, but the keep-plate of the *Eclipse* has been laid, and the material for the battleship *Majestic* is being prepared in readiness for her commencement shortly.

QUESTIONS IN PARLIAMENT.

Some very interesting statistics have been elicited from the Naval officials in the House of Commons recently, by members of an inquiring turn of mind. Why the questions are put it is not always easy to discern, but here are some of the replies. The annual cost of the powder used by the Navy for saluting is £1,585. The annual cost of the effective list of accountant officers is £130,060; of the chaplains, including allowances to ministers of religion, £33,253; and of the domestics, £94,164. The average age of the Indian troopships is 26 years and 6 months, and their average rate of speed, 10·9 knots an hour. There is accommodation in the existing training ships for 5,706 boys, while the boys under training are 3,700 in number, and there are 4,594 boys available for sea service. There are 5,791 boys borne on the books of the training ships, but 220 are in hospital, and there is usually a proportion amounting to about 3 per cent. in hospital during the winter months. The annual cost of a battleship during commission, including repairs, maintenance, sea stores, coal, pay, and victualling, is estimated to amount to £501,000. Out of 77 armourclad vessels owned by this country, 40 are armed with muzzle loading ordnance of obsolete type; most of these vessels, however, are supplied with modern quick-firing guns on the B.L. principle for their auxiliary batteries. There are 19 naval, and 17 military officers in the Naval Ordnance Department; that the latter should be so employed is in accordance with an arrangement made by the Admiralty with the Treasury when the stores were transferred from the War Office charge. As vacancies occur in certain of these appointments they will be filled by the promotion of warrant officers in the Navy.

CHATHAM DOCKYARD.

With the delivery of the *Leda*, there are eight vessels of this type in the Fleet Reserve here, namely, the *Skipjack*, *Sheldrake*, *Salamander*, *Jason*, *Circe*, *Niger*, and *Gossamer*. The *Niger* is to be employed on fishery duty, and a similar vessel, the *Gleaner*, was commissioned here for the Mediterranean on December 5th. The *Grasshopper* will also be ready to be put into the Fleet Reserve very shortly. A return from this yard

was recently called for giving a list of all vessels which had developed defects during the manœuvres, showing those which had been repaired and those still under repair. The latter now include only the *Grasshopper* and *Tribune*. The *Agincourt* and *Monarch* are still under repair here, and it is anticipated that the former will be completed by February next. The *Jason* is being fitted for commission, and the *Dryad*, which was launched here on November 25th, has had her boilers placed on board, and Messrs. Maudslay & Field are fixing the machinery, which will be of 3,500 H.P., and estimated to give her a speed of 19 knots. The *Blenheim* is having her ten 6-in. guns changed for a like number of 6-in. quick-firing guns. The *Landrail* is being overhauled and fitted as a tender to the *Thunderer* at Sheerness, to be used in the instruction of seamen in gunnery for long range firing in the North Sea. The top armament of the *Benbow* is to be increased by several 3-pounder quick-firing guns. She is marked to relieve the *Dreadnought* in the Mediterranean; the latter vessel, when she returns home, will pay off at Chatham, and the *Revenge* is also to be transferred to the Medway Reserve. The *Raven* is to be prepared for the surveying service here, and will relieve the *Stork*. All the first-class torpedo boats are in future to have their bottoms coated with Rahtjen's anti-fouling composition. The launch of the *Forte* on December 8th, following so closely on that of the *Dryad*, gives a promise of plenty of finishing work, while the laying down of the *Magnificent* and *Minerva* will also supply labour of other descriptions. It is expected that the *Terrible* will be laid down here next year. The ships in hand, repairing and completing, are the *Barfleur*, *Agincourt*, *Monarch*, *Grafton*, *Theseus* (making trials), *Tribune*, *Forte*, *Grasshopper*, and *Dryad*, with some older vessels, among them the *Satellite*, which is to be completed for a commission in the Pacific without delay.

Machinery Trials.

Very many important ships have made their machinery trials during the year, and as a rule with most satisfactory results. The following are among those to which reference in our columns during the past twelvemonth will give full particulars. The battleships *Hercules*, *Ramillies*, *Empress of India*; *Superb*, *Devastation*, *Resolution*, *Centurion*, and *Barfleur*. The cruisers of the first-class, *Crescent*, *Endymion* and *Grafton*; of the second-class *Bonaventure*, *Cambrian*, and *Astræa*, and of the third-class, *Barham*. The gunboats, *Alarm*, *Niger*, *Leda*, *Circe*, *Renard* and *Speedy*. The torpedo-boat destroyer, *Havock*. With reference to the *Bellona*, the Secretary of the Admiralty said recently, that although the tubes had been ferruled, her boilers were not giving satisfaction; but, on the other hand, in the *Barham*, a sister ship whose boiler tubes had been similarly ferruled, the same difficulty has not arisen. If further experience with the *Bellona's* tubes continues to be unsatisfactory, the boilers can be made efficient by retubing. The boilers of the *Bellona* are of the locomotive type and not single chamber boilers.

From this reply it might be supposed that the *Barham's* boiler tubes do not get choked now they are fitted with ferrules. A Malta correspondent, however, says on this point, "The *Barham* is not a bit different to her sister ship, *Bellona*, in this respect, and if full speed is ordered for more than four hours the whole of the ferrules get choked, and it is impossible to proceed. Fortunately the *Barham* has not been ordered, for some time, to proceed at full speed for more than four hours on this station; but when the occasion arises, the ship will simply be 'in the dirt tub.'"

Devonport Dockyard.

The whole of the machinery for the *Hermione*, has been supplied and fixed on board by the contractors, Messrs. J. & G. Thomson, of Clydebank. A new set of furnaces have been delivered for one of the *Sybille's* boilers by Messrs. Hawthorn, Leslie & Co., and it is hoped that this cruiser will be ready for her steam trials shortly. The *Pearl* cruiser is having her tubes ferruled and being supplied with additional flooding arrangements to her magazines. There have been two alarms of fire here recently, one on board the *Astræa*, and the other in the shipwrights' shop at Keyham, happily not serious outbreaks in either instance. The *Spider* is to have her boilers retubed and fitted with ferrules. The capstan engine of the *Antelope* has been tried and accepted, a weight of nine tons was raised by it 6 ft. in 14·5 seconds. A tender of Messrs. Bellis & Co. for the supply of two sets of air-compressing engines and pumps for the *Talbot* has been accepted, and that of Messrs. Allen & Co., electrical engineers, for the supply of electric lighting machinery for the same ship. The *Swinger* and *Espoir* gunboats, at this port, are to be converted into coal lighters. No. 56 torpedo boat, which broke down in the manœuvres, has been repaired and the trial reported upon satisfactorily. Some dredging operations have commenced here, but very much more work of this nature is required to make the stream fit for modern requirements. It is to be trusted also that not many months will pass before the additional dock and basin accommodation wanted here, is supplied. The *Astræa*, *Bonaventure*, and *Hermione*, cruisers, and *Antelope*, gunboat, are completing, the *Talbot* has been laid off, and the *Halcyon*, *Harrier*, and *Hussar* gunboats are on the slips. The two first-named gunboats are to be engined by Messrs. Hawthorn, Leslie & Co., and are being pushed ahead. The *Harrier* is to be ready for launching by the 20th of February, 1894, when the *Talbot* will be laid down on the slip she vacates.

Launches in 1893.

Twelve ships for the British Navy were launched during the year, most of these being second-class cruisers of the *Astræa* type, that vessel taking the water at Devonport, where she was built and engined. Other launches at that port were the *Hermione*, cruiser, and *Antelope*, gunboat. At Portsmouth the only launch has been the *Fox*, cruiser. At Chatham, the *Forte*, cruiser, and *Dryad*, gunboat, have taken the water. Two cruisers, the *Cambrian* and *Flora* have been put afloat at Pembroke, while a similar vessel, the *Charybdis*, was floated out at Sheerness. The vessels launched from private yards are the *Speedy*, gunboat, and *Daring*, torpedo boat destroyer, from Messrs. Thorneycroft's establishment at Chiswick, and the *Havock*, torpedo boat destroyer, from Messrs. Yarrow's, at Poplar. There are 42 of these torpedo boat destroyers now ordered from private builders, all to be completed by the summer of 1894.

New Regulations for Speed Trial.

For several years the most economical rate of speed at which vessels could steam was supposed to have been determined by what is known as Admiral Ryder's diagram method. The Admiralty have now issued an order directing that no further trials are to be made with this method, as it is not considered trustworthy. In future the captain of each vessel is to take the earliest opportunity when engaged on ordinary service in calm weather of ascertaining the most economical rate of speed of the ship, that is to say, the speed at which the greatest distance can be run per ton of coal per hour. For this purpose the engines are to be worked at different rates of speed for at least six hours at each rate, and the consumption of coal in hundredweights per hour, speed of ship, distance run per ton of coal, and the average I.H.P. developed, are to be carefully calculated and inserted in the engine-room register.

Pembroke Dockyard.

It is to be hoped that the attention which is being directed to naval affairs generally will include this yard and its many needs. Milford Haven is a harbour second to none in the United Kingdom so far as its facilities for warship construction and repair are concerned, all the more reason, therefore, that Pembroke Dockyard should be capable of meeting the calls which will be made upon it in the event of war. This establishment is in many respects behind the age, and that it turns out such excellent work and so cheaply, says much for those concerned in its management; nevertheless as compared with other yards it is at a great disadvantage. Take the case of the *Flora*, recently launched here, instead of being put into a basin, the vessel is taken down to Hobb's Point, the distance and indirectness of communication militating against speedy work. Of course the sheer legs and machinery at the Point make heavy weights to be handled with care, but the disadvantage lies in the means of transportation. What is required first is an extension of the railway line so as to connect the dockyard and the Point, and next, the excavation or enclosure of a basin. The *Cambrian* and the *Flora* are both at Hobb's Point at present, the gunboat *Hazard* and the battleship *Renown* are building in the yard. The *Renown* will give employment for many months, but what a penny-wise, pound-foolish system it is to be transferring men from this place to Portsmouth, instead of taking care that there shall be a fair amount of work for them here. It is rumoured, and we trust the rumour is correct, that another battleship is to be begun here very shortly.

THE DEFENCES OF PORTLAND.

It has now been recognised for some time that the seaports on the southern coast are very liable to torpedo boat attack at the commencement of a war. Nor is it possible to make them impregnable by means of booms, nets, &c. At Portsmouth, the fleet would either retire up the Solent and into harbour, at Plymouth it is questionable whether a fleet could be considered safe inside the breakwater, and at Portland experiment has demonstrated that considerable alterations are needed if an adequate security is to be obtained. It is at this last-named place that additional defences are now to be begun. The Admiralty have entered into a contract with Messrs. Hill & Sons, of Southampton, for the construction of a breakwater to start from the shore at the Nothe, Weymouth, and run out into deep water. It is also said that as a temporary measure, pillars of masonry will be built in the sea at distances of from 600 to 800 yards apart, between which booms could be constructed with other obstructions. Probably a breakwater will be eventually built to connect these pillars, and it is estimated that at least £1,000,000 will be the cost of the works, and that they will occupy ten years in construction. A coaling jetty has recently been completed at Portland, but according to the view of several experts it is totally insufficient for the purpose for which it is assumed to have been constructed. The coaling arrangements at the English naval ports are as far behind those of the French at Brest and Toulon as an old wooden line of battleship is behind the armourclads of modern times.

SHEERNESS DOCKYARD.

The gunboats completing for the pennant at this yard are being pushed ahead, and it is expected that all will be finished by the end of the month. The *Charybdis*, which was launched here in June last, and engined by Earle's Shipbuilding Co., is now on the point of making her trials. The *Firm* gunboat has arrived to pay off, and her crew having transferred to the *Niger* commissioned in her place, the *Firm* will be converted into a coal hulk. The vessels being completed for the Fleet Reserve are the *Charybdis*, *Alarm*, *Hebe*, *Renard*, *Onyx* and *Speedy;* the *Leda* has already been transferred to the Medway Fleet Reserve, and the *Jaseur* will also be brought on to this list soon. The *Gleaner!* which was commissioned at Chatham to relieve the *Sandfly* in the Mediterranean, passed her official inspection after embarking War Office stores at this port. Sheerness is particularly interested in this vessel, for she was built and engined at the port, and so far her machinery has given no trouble. The *Comus*, *Rambler*, and the *Cockchafer*, tender to the *Galatea*, are under repair or refit here. A large quantity of material has been prepared in advance for the construction of the *Torch* and *Alert*, and the engines of these vessels have been commenced in the steam factory.

NEW SURFACE CONDENSER.

The *Spider*, says the *Western Morning News*, is to be fitted with a condenser of special type for experimental trials. The apparatus is a new surface condenser for marine engines, the feed water for which is obtained at the temperature of the exhaust steam, consequently the boiler being fed with hot water, a considerable economy in fuel is effected, as well as a reduction in the wear and tear of the boiler. The condensing surface is rendered more efficient, thus enabling a smaller condenser to be used, and so effecting a considerable saving in weight and space. The apparatus is to be fitted to the *Spider*, so that the engineer students, who use that vessel for instructional purposes, may have ample opportunity of becoming acquainted with the various types of condensers. If the results are satisfactory, it is probable that the apparatus —which is applicable either as a main or as an auxiliary surface condenser—will be fitted to the *Sharpshooter* and *Spanker*, now being prepared for new sets of boilers.

VOICE TUBES FOR MEN-OF-WAR.

Several attempts have been made recently to improve the voice tubes of our men-of-war, and those of two naval officers have achieved a fair amount of success. Captain Martin J. Dunlop, who commanded the *Leander* in China, and is now in charge of the Devonport Dockyard Reserve has made some improvements in voice tubes with very satisfactory results. Captain H. Rose, of the *Rodney* has also been carrying out experiments in this direction. Anyone who has been in the conning tower of a warvessel will have noticed how all the mouth-pieces to these pipes are arranged close together, the difficulty has been chiefly to prevent messages sent through one tube passing through another, and also in hearing messages at all owing to the vibration when vessels are running at high rates of speed. Captain Rose discovered that by suspending some portions of the pipe by india rubber hangers, the communication can be carried on with less difficulty. Another improvement has been effected by removing the ordinary mouthpiece and substituting fitted ear and mouth pieces lined with indiarubber, and this arrangement is found to answer so well that it will probably be supplied to all small craft in which the vibration is excessive, at all events for communication between the bridge and the engine-room and stokeholds. An improved mouthpiece, the invention of Captain Dunlop, has recently been experimented with in the *Spider*, at Devonport, but it is generally acknowledged that there is still much room for improvement in these matters, tending as they must to the greater efficiency of our men of war.

NAVAL ENGINEERS AND ENGINEER STUDENTS.

The results of the Christmas examination of the engineer students at the Royal College at Keyham are reported to have been exceptionally good, and the Captain of the College has been desired by the Lords of the Admiralty to express their satisfaction to the winners of prizes, and to those honourably mentioned, at the progress made by them. The period of training for students has been reduced from five to four years, and their Lordships have directed that the course of instruction of the fourth-year students shall be so arranged as to ensure that their training and instruction in essential professional, and educational work are as complete as possible. It is intended next midsummer to enter eighteen students of four years' service as probationary assistant-engineers. These with the eight fifth-year students and two, who were formerly fitter-apprentices, will make an addition to the active service of complement of twenty-eight officers of this grade. The accommodation for students at the College has been found to be so inadequate that plans have been prepared for the building of a wing block to receive fifty-four additional pupils. This new block will comprise a large recreation-room, cloak-rooms, servants' bed-rooms, bath-rooms, &c., on the ground-floor. Overhead there will be fifty-four cubicles or cabins, and at the back four new lecture-rooms will be constructed. The extension will cost about £30,000, and the work will occupy about twelve months. Pending its completion lodgings will be hired outside for the overplus students.

INSTITUTE OF MARINE ENGINEERS.

THE TESTING OF BOILERS.

(*Concluded from page* 388.)

THE Chairman said he was inclined to think with Mr. Thomson that it was not necessary to subject a boiler to double the working pressure when applying the hydraulic test. They often found that after testing a boiler up to double the working pressure with water the boiler leaked before they reached a quarter of the pressure with steam. Why? It was because undue strains were set up, and he asked if it had ever occurred that some of those strains were set up by bad circulation. If they could obtain something that would prove a good circulator in a boiler while the steam was being raised they would not have so many defects and malformations in the furnaces and other parts as they now experienced.

Mr. Melsom stated that he proposed reading a paper very shortly on the "Hotchkiss Circulator," and he would provide a model for the purpose of illustrating its operation. The apparatus had been in use for some years as a boiler cleaner, and had been very successful, but so far had only been applied to land boilers. He saw the machine at work some time since, and thought at once that it would be a most valuable adjunct to marine boilers as well as land boilers, on the score of its being an automatic and unfailing water circulator, and a remover of grease and oil, as well as scale-forming matter from the boiler water. It could, with a few alterations, be made to suit the different conditions for marine work. Since then he had been in communication with the licencee, and together they had perfected the apparatus for marine purposes. The circulation of the boiler water commenced almost immediately after the fires were lighted, and continued the

whole time that there was a difference of temperature between the water at the water-line of the boiler and in the apparatus.

Mr. H. C. Wilson said he had listened with great pleasure and attention to Mr. Livesey's paper, and had closely followed the discussions which had ensued, but it appeared to him that the tendency among members had been to touch rather upon the design of boilers to stand certain tests than upon the tests that ought to be employed with given boilers. He was there for the purpose of being instructed, the more so as he had up till now been unable to find any mention in various books of reference of the proper way to conduct the testing of new and old boilers. He would suppose that to-morrow he had to test a given boiler, say an ordinary circular marine boiler with three furnaces. He should be very glad to hear from members present their opinions as to how he ought to proceed. He might have his own ideas on the subject, but should like to have them confirmed.

Mr. A. W. Robertson said the author of the paper solicited the opinions of members, and it would be very interesting to hear what course the last speaker would propose to follow in the testing of the boiler referred to.

Mr. Wilson said he would proceed somewhat as follows: It was presumed that some history of the particular boiler was known, and also that a careful examination had been made internally and externally, dimensions taken, and thickness, &c., of plates and stays noted for the purpose of procuring the working pressure. Now, he had to test this boiler to prove the safety of this calculated working pressure. He should fill the boiler quite full of water, and having lighted the fire in the centre or low furnace he would as gradually as possible raise the temperature of the water and, of course, the boiler as near 212° F. as he could. Then, having drawn the fire, he should proceed to apply hydraulic pressure, by means of a suitable pump, to twice the working pressure, unless the condition of the boiler upon examination previously induced him to reduce it. He should prefer that the water pumped in, not a great quantity, should be as hot as the pump would work with. If the boiler, upon examination under these conditions, showed no signs of any deformation or damage, he should, he thought, feel justified in working the boiler at the calculated pressure. The hydraulic testing of boilers with the water cold, although very valuable and convenient, did not of course set up in the boiler those subtle and irresistible strains in addition to the pressure per square inch, that were due to the expansion of the boiler under varying temperatures. It should be understood that the boiler he had applied his test to was quite an assumption, made for the purpose of getting, if possible, some information from members present, valuable not only to himself, but to the author of the paper who particularly asked for it.

Mr. A. W. Robertson said it was interesting and valuable to have the results of Mr. Wilson's experience, but Mr. Wilson went beyond even the rules laid down by the Board of Trade and Lloyd's for the testing of old boilers. The Board of Trade and Lloyd's required that if new furnaces were introduced into old boilers a test of double the working pressure should be applied, but he thought he was right in saying that when old boilers were tested without new furnaces there was no demand by either the Board of Trade or Lloyd's for double the working pressure.

Mr. Wilson: Is not that the minimum stated by the Board of Trade below which you may not go?

Mr. Robertson: That is all they ask for. Something had been said about a knowledge of the life and history of a boiler being necessary when considering the test to be applied; but he (Mr. Robertson) failed to see how the history of a boiler should become a factor in the testing at all. The Board of Trade and Lloyd's surveyors, irrespective of any treatment in the past, whether good or bad, satisfied themselves as to the condition of a boiler.

A Meeting of the Institute of Marine Engineers was held on October 23rd at the Institute premises, 58, Romford Road, Stratford, when the discussion was continued on the paper by Mr. J. F. Livesey, on "The Testing of Boilers." Mr. F. W. Shorey presided.

The Chairman, after some introductory remarks, read a communication that had been received from Mr. T. W. Fish, surveyor to Lloyd's Register at Glasgow, who wrote:—

"[Hy]draulic test carried to twice the working pressure to [as is] usual to subject new marine boilers is certainly of value as proving the quality of the material and workmanship employed, and as affording an opportunity for closely noting the behaviour of the more vital parts under the extreme pressure. In view of the factor of safety adopted by Lloyd's and the Board of Trade, this proof test cannot reasonably be considered injudicious or excessive; while its practical worth is generally acknowledged by experienced engineers, who desire a boiler in all respects to be safe, efficient, and durable. A member, in a written communication, while approving of the test to double the working pressure, would not insist on absolute tightness at that pressure. If in this case absolute tightness means an absence of keeping at any part of the boiler under test pressure, then this result is obtained in the majority of tests at shops of repute; and if a result other than this were deemed quite satisfactory, the question as to how far short of tightness, in all or certain parts, shall constitute sound workmanship, would, it is to be feared in too many instances, lead to serious misunderstandings and endless disputes between the parties concerned. A boiler under the usual conditions of hydraulic testing, having a uniform temperature throughout, is free from the strains set up by the varying temperatures of various parts when under steam; consequently a fair test of the material and workmanship is obtained from the water test, which would be attended with less risk than the steam test of about 30 per cent. in excess of the working pressure, as suggested by another member. The water test, being succeeded by the floating of the safety valves for the purpose of adjusting them to the working steam pressure, this operation conveys an opportunity for further examination of the boiler under the conditions in which they may be assumed thereafter to work. Broadly, it may be said where defects exist these will exhibit themselves during the hydraulic test; though undue rigidity of staying, and analogous faults, may result in heavier leakages under steam, but it should be borne in mind that such are faults of design. A valuable paper dealing with the alterations of form which take place in different parts of a boiler when under pressure, recently contributed by Mr. Milton to the Proceedings of the Institution of Naval Architects, is worthy of perusal as throwing light on the subject under discussion. The method of testing material to be used in boiler construction is alluded to, somewhat mysteriously, by Mr. Livesey as follows:—'The plates intended for use are not tested, but only strips cut from them . . .' Now, if strips cut from one plate be subjected to the usual tensile and temper and cold bending tests, and prove in each case satisfactory, the combined results serve to sufficiently indicate its good quality, also fitness for boiler-making purposes; and the plate may then be considered as having been tested. Such is the practice almost invariably observed in the testing of plates to be used in marine boiler construction. Mr. Livesey asks, 'What do these tests guarantee?' and himself replies, 'They guarantee only the quality of material at the time these tests are made.' It is difficult to conjecture what more should be expected from tests. Though the quality of the tested material become impaired by its subsequent manipulation in the boiler shop, the value of the tests are not thereby imperilled. Boilermakers as a matter of course, find fault with the quality of any tested steel plates which fail in their hands, but, as a rule, close and impartial investigation into their mode of manipulation and treatment of them furnish the causes responsible for the alleged failures; consequently the tests which the plates had successfully undergone retain their value as tests. Were an instrument capable of recording in two directions to a third place in decimals the deformations taking place in the different parts of a boiler under pressure placed on the market, apart altogether from the question of its utility, I fear there would be a remote prospect of its inclusion in the ordinary engine-room outfit. The present race of sea-going engineers evince small taste for observations of a microscopic nature bearing on the working conditions of the boilers under their charge; they are content to treat those conditions with a respect derived from the use of ruder appliances, and for their peace of mind perhaps it is just as well."

(*To be continued.*)

Opening of a Shipbuilding Yard at Sunderland.—The shipbuilding yard at South Hylton, Sunderland, which was acquired several months ago by the newly-established firm, Messrs. George McAndrew & Co., and which has since been fitted up by them in a very complete manner, so far as machinery and plant are concerned, is about to be opened for work, the firm having obtained an order for two vessels of a small class.

LIST OF VESSELS LAUNCHED IN 1893.

ENGLISH.

By J. Priestman & Co., Southwick, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Shillito	Steel	Steam	British	2324	190
† Murillo	"	"	"	2419	210

By J. L. Thompson & Sons, North Sands, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Cabo de la Nao ..	Steel	Steam	Foreign	1,551	115
† Cabo Tortosa ..	"	"	"	1,551	115
† Zodiac	"	"	British	2,918	300
† Condor	"	"	"	3,053	250
† Romney	"	"	"	2,806	250
† Massapequa ..	"	"	"	3,027	400
† Menantic	"	"	"	3,024	400
† Capac	"	"	"	3,052	250
† Cacique	"	"	"	3,052	250
† Cam	"	"	"	3,055	300
† Woodleigh ..	"	"	"	2,645	200
† Greta Holme ..	"	"	"	2,707	250

By James Laing, Deptford Yard, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Trocas	Steel	Steam	British	4,129	400
† Spondilus ..	"	"	"	4,129	400
† Umfuli	"	"	"	2,370	300
† Batoum	"	"	"	4,054	400
† Suram	"	"	"	3,629	300
† Vedra	"	"	"	4,057	400
† Rotha	"	"	"	1,042	130
† Mexicano	"	"	"	1,974	175

By Blyth Shipbuilding Co., Ltd., Blyth.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Lemgo	Steel	Steam	British	2,147	180

By Wm. Doxford & Sons, Ltd., Pallion, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Sagamore	Steel	Steam	Foreign	2,139	350
† Turret Age ..	"	"	British	2,231	350

By Short Bros., Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Wm. Middleton ..	Steel	Steam	British	2,539	220
† Bea Bellido ..	"	"	"	1,914	180
† Creole Prince ..	"	"	"	2,047	200
† Carib Prince ..	"	"	"	2,048	200
† Silverdale.. ..	"	"	"	2,716	220
† Italian Prince ..	"	"	"	3,083	250
† Westburn.. ..	"	"	"	3,320	300
† Victoria	"	"	"	3,284	300
† Whitburn.. ..	"	"	"	2,570	220

By Robt. Thompson & Sons, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Aristea	Steel	Steam	Foreign	1817·79	180

By S. P. Austin & Son, Wear Dockyard, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Scawsby	Steel	Steam	British	2,340	190
† Lutèce	"	"	Foreign	1,401	150
† Northdene ..	"	"	British	1,356	130

By Wm. Pickersgill & Son, Southwick, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
Margarita.. ..	Steel	Sail	British	527	—
Conway Castle ..	"	"	"	1,695	—

By Craig, Taylor & Co., Thornaby, Stockton-on-Tees.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
†[1] Luciline	Steel	Steam	British	3,319	250
†[1] St. Helens ..	"	"	"	4,007	275
† Falken	"	"	Foreign	1,376	120
[1] San Ignacio de Loyola ..	"	Sail	"	674	—

[1] To carry oil in bulk.

By Wm. Harkess & Son, East Slipway, Middlesboro'.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Olive	Steel	Steam	British	600	90
† Olimpia	"	"	Foreign	560	70
† Swansea	"	"	British	1,300	110

By Wm. White & Sons, West Cowes, Isle of Wight.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
* Mena	Composite	Steam	British	50	16½
† Saroslavna ..	Steel	"	Foreign	50	16½
† Samara	"	"	"	110	37

* Compound. † Triple. ‡ High Pressure.

By Edwards' Shipbuilding Co., Ltd., Howdon-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Pelotas	Steel	Steam	Foreign	2,325	170
Pontoon	Iron	—	British	to lift 3000 tn	

By Richardson, Duck & Co., South Stockton Iron Shipyard, Stockton-on-Tees.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Athen	Steel	Steam	Foreign	2,205	201
Caldy	"	"	British	3,042	256
Tees	"	"	"	569	105
Towy, Barge ..	Iron	Sail	"	59	—
Lot " ..	"	"	"	59	—
Noah " ..	"	"	"	59	—
Cain " ..	"	"	"	59	—
Tor " ..	"	"	"	59	—
Taff " ..	"	"	"	59	—
Leo, Screw Tug ..	Steel	Steam	"	55	39
Alecto	"	"	"	3,606	277
Scarsdale	"	"	"	2,589	219
Sirona	"	"	"	2,927	250
Courtfield.. ..	"	"	"	3,252	272
Mikado	"	"	"	3,600	270
To launch end of December ..	"	"	"	2,480	219

By Willoughby Bros., Plymouth.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* D. Burnett ..	Steel	Steam	British	400	20
‡ Bawdsey .. Floating Ferry	"	"	"	80	18

By Strand Slipway Co., Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Mimi	Steel	Steam	British	920	99

By Ritson & Co., Maryport.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Carl	Steel	Sail	Foreign	2,039	—
No. 64	"	"	—	1,384	—
Grace	Iron	Steam Paddle Tug.	British	183	80

By Cottingham Bros., Goole.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Young Fox ..	Wood	Sail	British	96 94/100	—

By Edwin Clark & Co., Brimscombe, near Stroud, Glos.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
‡ Eadale	Steel	Steam	British	—	10
‡ Vashti	"	"	"	—	6
* Doris	"	"	"	—	10
‡ Sirius	"	"	"	—	4
* Irene	"	"	"	—	3

By Day, Summers & Co., Southampton.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Lymington ..	Steel	Steam	British	130	60
* Lantana	"	"	"	164	50

By Williamson & Son, Workington, Cumberland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Bell Rock	Steel	Steam	British	368	60
Centesima ..	"	Sail	"	2,949	—
Alpha	"	Ligh'r	Foreign	100	—
Jersey	"	"	"	100	—
Guernsey	"	"	"	100	—

By Cochrane & Cooper, Grove Hill, Beverley.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Alice Isabel ..	Iron	Steam Tr'wlr	British	127	45
† Oregon	"	"	"	163	60
Iron Lighter ..	"	—	"	120	—
Ditto	"	—	"	120	—
Ditto	"	—	"	120	—
* Rhine	"	St. Tr.	"	118	45
* Rhone	"	"	"	118	45
* Rondo	"	"	"	118	45
† Imbricaria ..	"	"	"	150	45
† Germania.. ..	"	"	"	150	45
† Tasmania.. ..	"	"	"	150	45
† Jules Orban de Xivry ..	"	"	Foreign	153	50
† China	"	"	British	172	50
† Jamesia	"	"	"	172	50
† India	"	"	"	172	50

* Compound. † Triple. ‡ High Pressure

By Furness, Withy & Co., Ltd., West Hartlepool.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Plymyton	Steel	Steam	British	2,869	250
† Beltisloe	„	„	„	2,869	260
† Appomattox	„	„	„	2,875	412
† Chickahominy	„	„	„	2,875	412
† Greenbriar	„	„	„	2,875	412
† Twilight	„	„	„	1,929	180

By Union Co-operative Shipbuilding Co., Blyth.

* Tweedside	Wood	Steam	British	79·05	32

By T. G. Tagg, East Moseley, Surrey.

† Princess Beatrice	Wood	Steam	British	35	12
* Beryl May	„	„	„	3	2

And several small open boats.

By R. Craggs & Sons, Middlesbro' and Stockton-on-Tees.

† Emperor	Iron	St. Tr.	British	144	40
† Ran	Steel	Steam	Foreign	570	60
† Trawler	Iron	St. Tr.	—	144	40
† „	„	„	—	144	40
† Mexicano	Steel	Oil Str	British	—	—
† Brookline	„	Steam	„	1,350	180

By Bartram, Haswell & Co., South Dock, Sunderland.

† Queen Louise	Steel	Steam	British	3,385	350
† Kirkdale	„	„	„	2,834	310

By Ropner & Son, Stockton-on-Tees.

† Frey	Steel	Steam	Foreign	3,017	230
Barge	Iron	Sail	British	159	—
„	„	„	„	159	—
† Lyderhorn	Steel	Steam	Foreign	3,124	250
† Hannah M. Bell	„	„	British	2,998	190
† Eva	„	„	Foreign	3,129	250
† Beltor	„	„	British	3,020	200
† Dulwich	„	„	„	3,276	300
† Kilburn	„	„	„	3,271	300
† Woolwich	„	„	„	3,258	300
† Roxby	„	„	„	3,025	200

By John Blumer & Co., North Dock, Sunderland.

Sibun	Steel	Steam	British	1,796	190
Boston City	„	„	„	2,324	230
Kansas City	„	„	„	2,345	230
Terrier	„	„	Foreign	1,600	130

By Thomas Turnbull & Son, Whitehall Dockyard, Whitby.

† Gena	—	Steam	British	2,784	236

By Vosper & Co., Portsmouth and Hammersmith.

Fulna	Wood	Oil	British	8	6
The Lady Elizabeth	„	„	„	8	6
* Alice	Steel	Steam	Foreign	20	16
Hirondelle	Wood	Oil	British	10	8

By H. Fellows & Sons, Yarmouth.

Dwarf	Steel	Barge	British	—	—

By Cook, Welton & Gemmell, South Bridge Road, Hull.

* Chieftain	Iron	Steam	British	119·91	44
* Montreal	„	„	„	138·62	38
† Hercules	„	„	„	81·91	45
† Queensland	„	„	„	138·62	35
* Stork	„	„	„	151 50	48
* Edith	„	„	„	33·02	20
* George	„	„	„	150·21	48
* Labore et Honore	„	„	„	149·96	48
* Duke of York	„	„	„	149·96	48
* Duchess of York	„	„	„	150·46	48
* Humber	Steel	„	„	—	—
* Spartan	Iron	„	„	119·66	45
† Petrel	„	„	„	150·70	45
† Osprey	„	„	„	150 70	45
† Valkyrie	„	„	„	149·69	45
† Springfield	„	„	„	149·69	45
* Pr[illegible] Humber	„	„	„	150·46	48
* [illegible]	„	„	„	150·46	48

† Triple. ‡ High Pressure.

By W. H. Potter & Sons, Queen's Dock, Liverpool.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Mercador	Steel	Barge	British	110	—
Ormador	„	„	„	110	—
Adelia	„	Steam	„	28	—
Republica	„	„	„	300	—

By Harvey & Co., Ltd., Hayle.

† Hayle	Steel	Steam	British	423	73

By Simpson, Strickland & Co., Dartmouth.

a Blue Bell	Wood	Steam	British	30	15
a 35 Launch	„	„	Foreign	9	7
a Undine	„	„	British	15	12
a Gianetta	„	„	„	7	4
* 65 Launch	Steel	„	Foreign	26	8
* 3 Life Pinnaces for the Admiralty	Wood	„	British	33	7 each
a Alcyone	„	„	„	11	7
* Solent for H.M. Customs	Steel	„	„	21	15
a 48 Launch	Wood	„	Foreign	11	7
a 53 Launch	„	„	British	11	12
a Swallow	„	„	„	10	12
a 12 Small Launches	„	„	„	32	20
a 3 „ „	„	„	Foreign	10	6

By Camper & Nicholson, Gosport.

Anemone	Wood	Sail	British	86	—

By Edwd. Finch & Co., Chepstow.

* Cardiff	Steel	Steam	British	79·28	85
Barge	„	—	„	100	—
„	„	—	„	100	—
„	„	—	„	75	—
„	„	—	„	75	—
„	„	—	„	30	—
„	„	—	„	30	—
„	„	—	„	30	—

By G. Napier & Son, Crosshouse, Southampton.

* Prince	Steel	Steam	British	70	20

By W. H. Lean, Falmouth.

* W. H. L.	Wood	Steam	British	4	20

By Wm. Caisley, Howden Dyke.

Golden Wedding	Wood	Sail	British	240	—

By Earles' Shipbuilding & Engineering Co., Ltd., Hull.

† Chelmsford	Steel	Twin screw	British	1,635	4,500
† Swallow	Iron	Single screw	„	134	320
† Thrush	„	„	„	134	320
† Dee	„	„	„	151	320
† Don	„	„	„	151	320
† Dart	„	„	„	151	320
† Derwent	„	„	„	151	320
† Sutterton	„	„	„	160	320
† Zenobia	„	„	„	161	320
† Berlin	Steel	Twin screw	„	1,730	4,500

By Laird Bros., Birkenhead.

† City of Belfast	Steel	Steam	British	1,065	2,500
† Torpedo Boat	„	„	—	172	1,650
† Minto	„	„ India	H.M. n Government	960 ment	1,850
† Valiant	„	„	British	1,823	4,500
† Gun Boat	„	„	—	362	3,600

By John Stewart & Son, Ltd., Blackwall Iron Works.

† Athlete	Steel	Steam	British	119	68
* Useful	„	„	„	23	13
Patent Coaling Barge (Paul's Patent)	„ Engines and Boiler to work revolving shoot, not to drive her.	—	„	190	10

By Royden & Sons, Queen's Dock, Liverpool.

Prince Robert	Steel	Sail	British	2,846	—

* Compound. † Triple. a Quadruple. ‡ High Pressure.

By Rennoldson & Son, South Shields.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
Flying Spindrift..	Iron	Steam	British	146	80
Clarence	„	„	„	131	75
Greatham ..	„	„	„	132	75
Hutton	Wood	„	„	85	50
* Cavancha	Steel	„	Foreign	104	45
Annandale ..	Iron	„	British	129	50
Flying Phantom..	„	„	„	166	90
* Treleigh	„	„	„	419	45

By Chas. Hansen & Sons, West Cowes, Isle of Wight.

Lais	Composite	Sail	British	80	—

By Morris & Jeff, Junr., Grimsby.

† Dee	Iron	Steam	British	$61\frac{31}{100}$	45
† Don	„	„	„	„	45
† Dart	„	„	„	„	45
† Derwent	„	„	„	„	45

By J. G. Fay & Co., Ltd., Southampton.

Sletta-Maris ..	Wood	Sail	Foreign	19·22	—
Hoopoe	„	„	British	19·45	—
Satanita	Composite	„	„	117·02	—

By R. Smith & Co., Lytham, Lancashire.

* Luna	Steel	Steam	Foreign	70	35
* Progress ..	„	„	British	50	20
Four Barges ..	„	—	—	—	—
„ „ ..	„	—	Foreign	150	—
‡ Hong Seng Bie ..	„	Steam	„	70	35

By J. T. Eltringham & Co., Stone Quay, South Shields.

* Alacrity	Steel	Steam	British	286·04	42

By W. Thomas & Sons, Amlwch Port.

Cymric	Iron	Sail	British	226	—

By George & Thomas Smith, Rye, Sussex.

Vesta	Wood	Sail	British	31·26	—
Avona	„	„	„	32·73	—
Eleanora	„	„	„	34·47	—
Good Hope ..	„	„	„	76·64	—

By Bishop, Miles & Co., Bristol.

May Queen ..	Steel	Steam	British	27	20
May Flower ..	„	„	„	27	20

By Palmer's Shipbuilding and Iron Co., Ltd., Jarrow-on-Tyne.

Name of Vessel.	Built of.	Class.	Owners.	G. T. Regis.	H.P. I.
Iris	—	Steam	Foreign	2,333	1,200
Aras	—	„	British	3,210	1,560
Erevan	—	„	Foreign	2,419	1,250
Anthony Radcliffe	—	„	British	2,866	1,250
Lydgate	—	Sail	„	2,534	—
Loch Tay.. ..	—	Steam	„	5,181	2,200
Newark	—	„	„	1,000	800

By Wigham Richardson & Co., Newcastle-on-Tyne.

Kalman Kiraly ..	Steel	Steam	—	2,249	1,350
Clengariff.. ..	„	„	—	1,286	3,300
Pfalz	„	„	—	3,849	2,700
Ramses	„	„	—	3,634	1,500
Nagy Lajos ..	„	„	—	2,285	1,350
Petöfi	„	„	—	2,250	1,350
Stefania	„	„	—	2,300	1,450
Warrigal ..	Engines only		—	—	3,600
Tisza ..			—	—	700
Mark ..			—	—	2,700

By William Dobson & Co., Low Walker, Newcastle-on-Tyne.

† Marie	Steel	Steam	Foreign	1,279	860
† Acme	„	„	British	2,280	1,200
† Linden	„	„	„	400	400
† F. C. Andersen ..	„	„	„	590	—
† Fifty	„	„	„	3,191	1,500

* Compound. † Triple. ‡ High Pressure.

By Wm. Gray & Co., Ltd., West Hartlepool.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Clam	Steel	Steam	British	3,552	2,000
Elax	„	„	„	4,014	2,250
Volute	„	„	„	4,006	2,250
Burma	„	„	Foreign	3,078	1,500
Oscar II.	„	„	„	3,056	1,300
Webster	„	„	British	3,101	1,500
Nador	„	„	Foreign	2,030	950
Adjutant	„	„	British	2,392	1,250
Roumania ..	„	„	„	2,409	1,300
Penarth	„	„	„	3,109	1,500
Demetrio S. Schilizzi	„	„	Foreign	2,034	1,000
Bullmouth ..	„	„	British	4,018	2,250
Ariadne Alexandra	„	„	„	1,985	1,000
Baracaldo ..	„	„	Foreign	1,180	700
David Mainland..	„	„	British	1,897	900
Pacific	„	„	„	2,600	1,500
Horsa	„	„	„	2,930	1,200
Castanos	„	„	„	2,958	1,500

By Sunderland Shipbuilding Co., Sunderland.

† Hanoi	Steel	Steam	Foreign	1,199	1,150
† Hongkong ..	„	„	„	1,199	1,150
a Warrigal	„	„	British	4,387	3,500
† Celte	„	„	Foreign	950	1,000

By Wood, Skinner & Co., Bill Quay, Newcastle-on-Tyne.

† Skeffington ..	Steel	Steam	British	941	700
† Holmside	„	„	„	842	600
† Wallsend	„	„	„	899	600
† James Tennant ..	„	„	„	207	200

By Summers & Scott, Gloucester.

* Mosquito	Steel	Steam	British	55·2	220
* No. 61	Composite	„	Foreign	43·4	90
* Stella	Steel	„	„	9·46	75

By Anderson & Laverick, St. Laurence, Newcastle-on-Tyne.

* Stewart	Steel	Steam	British	141	425
* Dragon	„	„	„	290	300
* Rescue	„	„	„	92	300
* Cornubia	„	„	„	290	300
* Keelrow	„	„	„	140	155

By R. & H. Green, Blackwall.

* United	Iron	Twin Screw	British	164	625
Oanfa	Steel	L'ghtr	„	—	—
Aopack	„	„	„	—	—
* Steam Lifeboat ..	„	Hydr.	„	—	200
* President van Heel	„	„	Foreign	—	200

By Cochran & Co., Birkenhead.

* Salvage	Steel	Steam	British	15	65
* Arauha	„	„	„	25	150
* Ismay	Wood	„	„	7	20
‡ Offioug Ohoho ..	„	„	„	6	15
No. 1 Barge ..	„	Tow'g	„	20	—
„ 2 „ ..	„	„	„	20	—
„ 3 „ ..	„	„	„	20	—
„ 4 „ ..	„	„	„	20	—
„ 5 „ ..	„	„	„	20	—
„ 6 „ ..	„	„	„	20	—
‡ Steam Launch ..	„	Steam	Foreign	5	12
‡ Queen of the Prah	„	„	„	5	12
‡ Steam Launch ..	Steel	„	„	10	25
* Alphonso ..	Wood	„	„	20	35
* Egerton	„	„	„	10	35

By John Readhead & Co., West Docks, South Shields.

† Cambay	Steel	Steam	British	2,631·95	1,350
† Trefusis	„	„	„	2,641·67	1,350
† Thomas Wayman	„	„	„	2,209.87	1,000
† Cayo Romano ..	„	„	„	2,689·52	1,400
† Asturian Prince ..	„	„	„	3,147·10	1,600
† Edenmoor ..	„	„	„	3,106·52	1,400
† Ville d'Arras ..	„	„	Foreign	1,610	1,100
* Ville de Marseilles	New Engines only				850

* Compound. † Triple. a Quadruple. ‡ High Pressure.

By R. & W. Hawthorn, Leslie & Co., Ltd., Hebburn-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† Perthshire ..	Steel	Steam	British	5,550	3,000
† Buteshire	„	„	„	5,550	3,000
† H.M.S. Halcyon	Twin Screw Engines only			—	3,500
† H.M.S. Harrier				—	3,500
† H.M.S. Hussar				—	3,500

By John Jones & Sons, Brunswick Dock, Liverpool.

† St. Brieuc ..	Steel	Steam	Foreign	400	420

By Cox & Co., Dock Iron Works, Falmouth.

† Dragon	Steel	Steam	—	167·50	510
† Sir Frederick ..	Composite	„	—	133·88	440
* Queen of the Fal	Steel	„	—	69·80	220

By Naval Construction and Armaments Co., Ltd., Barrow-in-Furness.

† Flora	Machinery only		—	—	9,500
† Northern Light ..	Steel	Steam	British	3,894	2,540
† Warren Hastings	„	„	Foreign	3,901	7,450
† Brancker	„	„	British	2,511	1,800
† Accra	„	„	„	2,809	1,800
† Bathurst	„	„	„	2,809	1,800
† Venetia	„	„	„	819	1,550
† Batanga	„	„	„	2,809	1,800
† Clan Drummond	Tripling	—	—	—	2,500
Kirkless	New Boilers		—	—	600

By Sir W. G. Armstrong, Mitchell & Co., Ltd., Low Walker, Newcastle-on-Tyne.

Roland	Steel	Steam	Foreign	3,691	2,000
James Brand ..	„	„	British	3,907	1,750
Blanca Encalada	„	„	Foreign	4,400	14,500
Lucigen	„	„	British	3,416	1,800
Snowflake ..	„	„	„	2,900	1,400
Mark	„	„	Foreign	3,900	2,400
Georgian Prince ..	„	„	British	3,246	1,700

By Robert Stevenson & Co., Hebburn-on-Tyne.

Lock Gate ..	Iron	—	British	200	—
„ ..	„	—	„	200	—
„ ..	„	—	„	200	—
„ ..	„	—	„	200	—
„ ..	„	—	„	160	—
„ ..	„	—	„	160	—
Pontoon	„	—	„	290	—
Floating Dock ..	„	—	„	—	—
† Castillian Prince .	Steel	Steam	„	Eng. & Boilers only.	1,100
† Regal	Iron	„	„		1,100
Siren	„	„	„		—

By Tyne Iron Shipbuilding Co., Ltd., Willington Quay-on-Tyne.

† William Storrs ..	Steel & Iron	Steam	British	3,623	1,500
† Mancunium ..	Steel	„	„	671	400
† Duffield	„	„	„	3,850	1,900

By Sir Raylton Dixon & Co., Middlesbrough.

Stolzenfels ..	Steel	Steam	Foreign	3,093	1,250
City of Kingston ..	„	„	British	844	1,390
Phœnix	„	„	„	2,692	1,250
Embiricos ..	„	„	Foreign	2,708	1,2(0
S.W.R., No. 1 ..	Steel & Iron	„	British	490	225
Egyptian	Iron	„	„	141	250
Bannockburn ..	Steel	„	„	1,620	1,100
Coquet	„	„	„	2,298	1,170
Zaire	„	„	Foreign	3,156	2,500
Hotham Newton .	„	„	British	2,661	1,400
Cimbria	„	„	Foreign	224	350
Fijian	Iron	„	British	141	250
Humberts Rodriguez	Steel	„	Foreign	292	700
Ayresome Ironwork, No. 2 ..	Iron	Barge	British	350	—
Rothenfels ..	Steel	Steam	Foreign	2,951	1,250
Lindenfels ..	„	„	„	2,951	1,250

* Compound. † Triple. ‡ High Pressure.

By Swan & Hunter, Wallsend-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† Castillian Prince	Steel	Steam	British	2,315	1,100
† Zeno	„	„	„	2,895	1,500
† Westmeath ..	„	„	„	6,120	3,000
† Mexican Prince ..	„	„	„	3,027	1,100
† Cayo Mono ..	„	„	„	2,711	1,400
† Maori	„	„	„	5,200	2,400
† Œolus	„	„	„	2,895	1,500
† Indralema ..	„	„	„	3,030	1,600
† Unionist	„	„	„	2,895	1,500

By Forrestt & Son, Wyvenhoe, Essex, and Limehouse.

* Yacht's Launch ..	Wood	Steam	British	2·3	6
Lifeboat, David Pickard	„	Sail	„	8	—
3 Admiralty Cutters	„	„	„	10	—
* 2 Steam Pinnaces	„	Steam	Foreign	3 each	12 ea.
* 9 Admlty. Vedettes	„	„	British	12 „	200 „
‡ Cargo Steamer ..	Galv. Steel	Pad'le.	Foreign	50	100
* Yacht's Launch ..	Wood	Steam	British	2·3	6
Barge	Galv. Steel	—	Foreign	5	—
„	„	—	„	5	—
„	„	—	„	8	—
Launch	„	Steam	„	4	6
Titsan	Wood	Sail	British	2	—
Arab	„	„	„	2.5	—
‡ Forester	Steel	Steam	„	7	20
Lifeboat	„	Sail	Foreign	4	—
Barge	Galv. Steel	„	„	12	—
„	„	„	„	12	—
„	„	„	„	5	—
„	„	„	„	5	—
Whale Boat ..	„	„	„	1·5	—

Craft built at Norway Yard, Limehouse.

Admiralty Cutter .	Wood	Steam	British	—	—
„ „	„	„	„	—	—
„ Launch	„	Sail	„	—	—
„ „	„	„	„	—	—
„ Pinnace	„	„	„	—	—
„ „	„	„	„	—	—
Steam Cutter ..	„	Steam	„	—	—
Lifeboat	„	Sail	Foreign	—	—
„	„	„	„	—	—
Launch Hull ..	„	—	British	—	—
Cargo Drogher ..	„	—	„	—	—
„ „ ..	„	—	„	—	—
Fishing Boat ..	„	Sail	„	—	—
„ „ ..	„	„	„	—	—
Surf Boat ..	„	„	„	—	—
„ „ ..	„	„	„	—	—

And 30 Admiralty Boats, from 32 ft. down to 10 ft., and 28 Ships' Boats, sailing and rowing.

Messrs. Yarrow & Co., Poplar, London.

One paddle-wheel steamer, 85 ft. by 15 ft. beam, fitted with high-pressure engines. Foreign service.

One single-screw steel steam launch, 50 ft. long by 9 ft. beam, fitted with high-pressure engines. Draft 12 in. Foreign service.

Two steel launches, 36 ft. long by 8 ft. beam. Home service.

One steel steam launch, 30 ft. long by 8 ft. beam; high pressure engine; tubulous boiler. Foreign service.

One paddle-wheel steamer, 120 ft. long by 24 ft. beam, high-pressure engines, locomotive boiler. Foreign service.

Complete machinery for a steam launch (high-pressure engines, locomotive boiler). Foreign service.

One shallow draft steel steam launch, 60 ft. long by 8 ft. 6 in. beam, high-pressure engines, locomotive boiler. Draft 18 in. Foreign service.

One steel steam launch, 55 ft. long by 7 ft. beam, high-pressure engines, return tube boiler. Foreign service.

One second-class torpedo boat, 60 ft. long by 9 ft. 3 in. beam; compound condensing engines; tubulous boiler. Foreign Government.

Machinery for gunboat, 2 sets of triple-expansion engines,

* Compound. † Triple. ‡ High Pressure.

including all auxiliary machinery, 4 locomotive boilers. Home service.

One single-screw steel steam launch, 37 ft. long by 7 ft. beam; pair of high-pressure engines, horizontal boiler. Foreign service.

One fast torpedo boat destroyer, 180 ft. long by 18 ft. 6 in. beam; twin-screw triple-expansion engines, locomotive boilers. Home service.

One fast torpedo boat destroyer, 180 ft. long by 18 ft. 6 in. beam; twin-screw triple-expansion engines, fitted with "Yarrow's" patent water tube boilers. Home service.

Two first-class torpedo boats, 142 ft. long by 14 ft. beam, single-screw triple-expansion engines, locomotive boilers. Home service.

One first-class torpedo boat 140 ft. long by 14 ft. 3 in. beam, single-screw quadruple-expansion engines, fitted with "Yarrow's" patent water tube boilers. Home service.

SCOTCH.

By Ramage & Ferguson, Ltd., Leith.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
† Gundreda	Steel	Steam	British	386	100
Royal Forth	„	Sail	„	3,180	—
† Cleopatra	„	Steam	„	660	126
† Vala	„	„	„	1,016	82

By James Adam, Gourock.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
Gipsey	Wood	Sail	British	5	—
Brunette	„	„	„	5	—
Pukererier	„	„	„	2	—
Govern. Cutters, 3	„	—	„	15	—
Do. Dinghys, 3	„	—	„	3	—
* Launch	„	Steam	„	10	—
Several Yachts, Boats and Gigs	„	—	„	10	—

By S. M. Knight & Co. Ayr.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
* Christina	Steel	Steam	British	500	90
* Canada	„	„	„	160	74

By W. B. Thompson & Co., Ltd., Dundee.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
Barge	Steel	—	British	50	

By Mackie & Thomson, Govan, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
† Knight Templar	Steel	Steam	British	164·27	68
† Golondrina II.	„	„	Foreign	706·47	130
† Etruria	Iron	„	British	154·07	45
† Bittern	Steel	„	„	141·13	35
† Cygnet	„	„	„	141·13	35
† Halcyon	„	„	„	141·13	35
† Osprey	„	„	„	141·13	35
† Stork	„	„	„	141·13	35
† Teal	„	„	„	141·13	35
* Energy	Steel&Iron	„	„	144·74	40
* Expedient	„	„	„	144·74	40
† Enterprise	„	„	„	144·74	45
† Economy	„	„	„	144·74	45
† Hercules	Steel	„	„	168·19	45
† Cetus	„	„	„	139·04	40
† Corvus	„	„	„	139·77	40

By Alley & MacLellan, Polmadie, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
* No. 151	Steel	Pad'le	British	49	35
* No. 152	„	„	„	49	35
No. 153	„	Sail	„	193	—
No. 154	„	Barge	„	7	—

By Alexander Stephen & Son, Dundee.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
Newfield	Steel	Sail	British	1,512	—

By Wm. Hamilton & Co., Port-Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
* Eureka	Steel	Steam	—	164	40
* Susu	Iron	„	—	190	60
Almora	Steel	Sail	—	1,857	—

By Gourlay Bros. & Co., Dundee.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
† Matin	Steel	Steam	British	3838·45	400
† Villam	„	„	Foreign	646·40	190
† Nour-el-Bahr	„	„	„	295·30	70

* Compound. † Triple. ‡ High Pressure.

By A. Hall & Co., Footdee, Aberdeen.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Hermes	Steel	Steam	British	167	60
* Edith	„	„	„	148	30
* Mary Stewart	„	„	„	165	50
* Ossifrage	—	—	„	—	30

By Russell & Co., Port-Glasgow, and Greenock.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
Ancona	Steel	Sail	British	2851·66	—
Bermuda	„	„	„	2846·17	—
Bahama	„	„	„	2244·63	—
Levernbank	„	„	„	2400·06	—
Laurelbank	„	„	„	2397·13	—
Kinross-shire	„	„	„	2298·68	—
King George	„	„	„	2241·61	—
Dowanhill	„	„	„	2115·08	—
Clan Graham	„	„	„	2147·26	—
Marathon	„	„	Foreign	1988·14	—
Arranmore	„	„	British	1946·39	—
Marie Hackfeld	„	„	Foreign	1784·75	—
Port Elgin	„	„	British	1761·96	—
Seafield	„	„	„	1646·17	—
Lota	„	„	„	1642·91	—
Serena	„	„	„	1638·69	—
Gael	„	„	„	1629·68	—
Saxon	„	„	„	1636·66	—
Kilmallie	„	„	„	1634·29	—
Auldgirth	„	„	„	1591·20	—
Inverkip	„	„	„	1465·87	—
Inverlyon	„	„	„	1450·13	—
Beeswing	„	„	„	1462·06	—
Oberon	„	„	„	1119·39	—
Alida	„	„	„	413·85	—
Elmwood	„	„	„	369·43	—
Elizabeth	„	„	„	369·37	—

By Barclay, Curle & Co., Ltd., Whiteinch, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Vulcan	Steel	Steam	British	288	155
* Princess May	„	„	„	260	87
Norma	„	Sail	„	2,122	—
* Neptune	„	Tug	„	165	54
Otterburn	„	Sail	„	2,668	—
Miltonburn	„	„	„	2,663	—
† Rutland	„	Steam	„	1,448	171
Ben-Lee	„	Sail	„	2,341	—
Lamorna	„	„	„	2,318	—

By Robert Duncan & Co., Ltd., Port-Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
Morven	Steel	Sail	British	2,150	—
Pass of Killiecrankie	„	„	„	1,746	—

By Caird & Co., Greenock.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Japan	Steel	Steam	British	4,319	500

By Marshall & Co., Maryhill, N.B.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
* Gnome	Steel	Steam	British	92	30

By J. & J. Hay, Kirkenklloch, N.B.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
* Nelson	Iron&Steel	Steam	British	80	20
* Briton	„	„	„	80	20

By John Reid & Co., Ltd., Whiteinch, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
Deirdré	Composite	Cutter	British	20	—
* Nykr	Steel	Yacht	„	30	45
† Empress	„	Pad'le	„	156	200
2 Lighters	„	Cargo	Foreign	100	—
* Estrella	„	Steam	„	15	20
Ariel	„	S. Wh.	„	60	—
Spendrift	„	„	„	60	—

By James Millar, St. Monas, N.B.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
* Glenavon	Wood	S.&sa.	British	—	Abt.35
* Ossifrage	„	„	„	—	„ 35
* Merganser	„	„	„	—	„ 35

By Adam Marr, Leith.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
* Ebenezer	Wood	Steam	British	90	55
* May Flower	„	„	„	90	55
* Kate	„	„	„	90	55

* Compound. † Triple. ‡ High Pressure.

By Montrose Shipbuilding Co., Ltd., Montrose, N.B.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
Joachim	Steel	Sail	Foreign	287·35	—
No. 6	Iron&Steel	Barge	British	38	—
,, 7	,,	,,	,,	35	—
* ,, 9	Steel	Steam	,,	55	—
* ,, 10	,,	,,	,,	55	—

By Scott & Sons, Bowling, Glasgow.

† Spinel	Iron&Steel	Steam	British	509	68
* Sweet Home ..	,,	,,	,,	180	33
* Beryl	,,	,,	,,	402	66
* Marmion	,,	,,	,,	324	70
* Eagle	,,	,,	,,	90	17
* Jargoon	,,	,,	,,	501	81

By Stevenson & Asher, Macduff, N.B.

Hardy	Wood	Sail	British	36	—
Topaz ..	,,	,,	,,	36	—
Pomegranite ..	,,	,,	,,	36	—
Chrysolite.. ..	,,	,,	,,	36	—
Annie Wilson ..	,,	,,	,,	38	—
Gowan	,,	,,	,,	36	—

By Fife & Son, Fairlie.

Norka	Wood	Lug'er	British	9	—
Snarley-yow ..	,,	,,	,,	5	—
The Scot	,,	Sloop	,,	4	—
Almida	,,	Cutter	,,	20	—
Dragon	Composite	,,	,,	40	—
Lala	Wood	Lug'er	,,	9	—
Zinita	Composite	Cutter	,,	40	—
Thaber	Wood	Lug'er	,,	9	—

By Forbes & Birnie, Peterhead, N.B.

* Britannia.. ..	Wood	Steam	British	29	—
* Pioneer	,,	,,	,,	17 8/100	32

By D. U. Cumming, Blackhill Dock, Glasgow.

No. 50	Steel	Sail	British	27	—
* Fairy	,,	Steam	,,	38	13
‡ Toxteth	,,	,,	,,	65	10
No. 69	,,	Sail	,,	27	—
,, 70	,,	,,	,,	27	—
,, 10	,,	,,	,,	27	—

By Alexr. Stephen & Sons, Linthouse, Govan, Glasgow.

† Bezwada	Steel	Steam	British	5,251	380
† Arabistan.. ..	,,	,,	,,	3,353	500
† Rappahannock ..	,,	,,	,,	4,078	600
† Shenandoah ..	,,	,,	,,	4,080	600
† Benmohr	,,	,,	,,	3,150	285
† Kanawha	,,	,,	,,	4,078	600
† Halifax City ..	,,	,,	,,	2,240	320

By A. McMillan & Son, Ltd., Dumbarton.

Seagull	Steel	Steam	British	742	—
Havila	,,	Sail	Foreign	1,414	—
Queen Margaret ..	,,	,,	British	2,144	—
Thetis	,,	,,	,,	343	—
Blairmore ..	,,	,,	,,	1,917	—
Therese et Marie .	,,	Steam	Foreign	1,620	—
Lucie et Marie ..	,,	,,	,,	1,620	—
Eagle Craig ..	,,	Sail	British	1,433	—
Maréchal Suchet..	,,	,,	,,	1,920	—

By J. H. Gilmour, Irvine.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
* Miner	Steel	Steam	British	400	650
* Fairy Queen ..	,,	,,	,,	100	75
* Erne (Twin Screw)	,,	,,	,,	50	200
* Devonia	Iron	,,	,,	150	300

By John Scott & Co., Kinghorn, Fife.

† Peo Patria ..	Steel	Steam	Foreign	673	1,000
† Saturnus	,,	,,	,,	913	1,100
* Princess Melita ..	,,	,,	,,	120	350

npound. † Triple. ‡ High Pressure.

By Simons & Co., Renfrew, N.B.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
† Waterloo	Steel	Hop'r Dredg	British	550	550
* St. Michael ..	,,	,,	,,	700	1,000
* Parahyba-de-Morte	,,	Tug	Foreign	50	120
* No. 76	,,	Crane Hop'r Barge	British	200	250
† Pholas	,,	Hop'r Dredg	Colonial	500	600
† No. 21	,,	Hop'r Barge	British	1,220	1,550
† No. 22	,,	,,	,,	1,220	1,550
Hutton	,,	Ferry St'm'r	,,	600	700

By James & George Thomson, Ltd., Clydebank, Glasgow.

Nile	Steel	Steam	British	5,950	8,000
Danube	,,	,,	,,	5,950	8,000
Kensington ..	,,	,,	,,	9,000	7,000
Minerva	,,	,,	,,	306	1,700
Glen Rosa ..	,,	,,	,,	306	1,700
Slieve Donard ..	,,	,,	,,	340	1,700
Hermione (cruiser)	Machinery	only	,,	—	9,000
Moor, general over	haul, lengt	hening	,,	—	5,000

By Ailsa Shipbuilding Co., Troon.

Holywood (barque)	Steel	Sail	British	1,633	—
Dalrymple ,,	,,	,,	,,	1,634	—
* Calchfaen ...	,,	Steam	,,	421	525
† Bahaduri ..	,,	,,	,,	1,590	2,000
* Blanche Rock ..	,,	,,	,,	471	500

By Grangemouth Dockyard, Co., Grangemouth.

† Ciudad de Reus ..	Steel	Steam	Foreign	1,900	1,300
† Antilia	,,	,,	,,	1,050	800
La Viguesa ..	,,	Sail	,,	965	
† St. Bernard ..	,,	Steam	British	166	650
† Spaniard ..	,,	,,	Foreign	1,200	800

By Napier, Shanks, & Bell, Yoker, Glasgow.

† Kwei Lie (') ..	Steel	Steam	Foreign	1,830	900
† Maria	,,	,,	British	671	1,150
Barge (')	,,	Sail	Foreign	23	—

(') Shipped abroad in pieces.

By Murdoch & Murray, Port-Glasgow.

* Maggie Barr ..	Steel	Steam	British	360	450
† Rio Purus ..	,,	T.S.	Foreign	429	400
† Tejo	,,	,,	,,	312	500
† Juruá	,,	,,	,,	417	600
a Blackpool } Twin	,,	{ Hop'r	British	300	340
a Lytham } S.S.	,,	{ Barg's	,,	300	340

By Seath & Co., Rutherglen, Glasgow.

Passenger Steamer	Steel	T.S.	Foreign	171	200
———	,,	Sail	,,	73	—
Barge	,,	,,	,,	13	—

By John Fullerton & Co., Paisley.

* Killowen	Steel	Steam	British	227·65	390
* Emily	,,	,,	,,	226·69	390
* Cumberland ..	Iron	,,	,,	395·69	475
* Yorkshire.. ..	,,	,,	,,	393 90	475
* Seagull	Steel	,,	,,	144·47	140
* Aggie	Iron	,,	,,	182·87	250
* Ringsend	Steel	,,	,,	396·10	475

By London and Glasgow Shipbuilding Co., Govan, Glasgow.

† Oolong	Steel	Steam	British	3,583	2,240

By A. & J. Inglis, Pointhouse, Glasgow.

† Potomac	Steel	Steam	British	3,869	2,730
* Vida	,,	,,	,,	112	96
† No. 227	,,	,,	,,	538	460
* Gretchen	,,	,,	,,	78	99
† No. 230	,,	,,	,,	1,700	3,400
Calluna	Composite	Sail	,,	259	—

* Compound. † Triple a Quadruple. ‡ High Pressure.

By Campbeltown Shipbuilding Co., Campbeltown.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
† Vanland	Steel	Steam	Foreign	1,241	105
† Corso	,,	,,	British	1,252	102

By Fleming & Ferguson, Paisley.

* Dredger, St. David	Steel	Steam	British	800	600
* Launch, Inspector	,,	,,	,,	80	100
a s.s. Archd. Finnie	,,	,,	,,	700	1,000
† Clyde Hopper steamer, No. 19	,,	,,	,,	1,200	1,200
† Clyde Hopper steamer, No. 20	,,	,,	,,	1,200	1,200
† Hopper Dredger Erin-go-Bragh	,,	,,	,,	400	500
* Steel Dredger ..	,,	,,	,,	800	600

Four sets patent quadruple-expansion engines, shipped abroad, 4,200 I.H.P.

By D. & W. Henderson & Co., Partick, Glasgow.

† Tritonia	Steel	Steam	British	4,272	2,600
† Princess Beatrice	,,	,,	,,	1,146	1,400
Britannia	Composite	Sail	,,	221	—
Valdyrie	,,	,,	,,	191	—
† Olive	Steel	Steam	,,	1,141	2,500
Corunna	,,	Sail	,,	2,431	—
† Christabel ..	,,	Steam	,,	321	600
† Rona	,,	,,	,,	1,000	1,900

By Robt. M'Allister & Son, Dumbarton.

* Malvina	Wood	Steam	British	25	55
* Robin	,,	,,	,,	15	30
* Vigiliant	,,	,,	,,	7	12

By Lobnitz & Co., Slip Dock, Renfrew.

6 Lighters ..	Steel	—	British	720	—
† L. P. Holmblad ..	,,	Steam	Foreign	3,000	1,300
† 6 P.A. Koch ..	,,	,,	,,	1,000	1,350
* No. 404, Sand Pump Dredger	,,	,,	British	500	500
* Muri	,,	,,	,,	350	300
‡ Sternwheel Steam'r	,,	,,	Foreign	75	100
* Eugenie	,,	,,	,,	100	200
* Toro (Yacht) ..	,,	,,	British	63	90

By David J. Dunlop & Co., Port-Glasgow.

† Delaware	Steel	Steam	British	4,000	3,000
† Croft	,,	,,	,,	800	900
† Lackawanna ..	,,	,,	,,	4,000	3,000
* White Rose ..	,,	,,	,,	50	300
Mayrink	New boilers.			—	—
Factory	New boilers.			—	—
Louise	New boilers, and machinery overhauled				
Soudan	New boilers.			—	—

By Cumming & Ellis, Inverkeithing, N.B.

† Sea King	Steel	Steam	British	180	700
Marie Louise ..	,,	Sail	Foreign	354	—
Senorita	,,	,,	,,	350	—
Bertha	,,	,,	,,	260	—

By Scott & Co., Cartsdyke, Greenock.

Princess Margaret	Steel	Steam	—	260	750
Borgnis Disbordes	,,	,,	—	232	350
Kittiwake	,,	,,	—	240	160
Well Park	,,	,,	—	860	680
Glen Park	,,	,,	—	860	680
4 Lighters	,,	536 tons each		2,144	—

By Charles Connell & Co., Whiteinch, Glasgow.

Zinita	Steel	Sail	British	1630	—
Arno	,,	,,	,,	1824 66	—
Ems	,,	,,	,,	1828·82	—
Glenclova	,,	,,	,,	2369·14	—
Gulnare	,,	Steam	Colonial	261·95	450
Micmac	,,	,,	,,	2502·42	1,500
Catalina	,,	,,	Foreign	5060·66	3,000
Bourbon	,,	,,	British	1587·52	1,150
Eskdale	,,	,,	,,	2995·53	1,150

* Compound. † Triple. a Quadruple. ‡ High Pressure.

By John Shearer & Son, Kelvinhaugh.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
† Turquoise	Steel	Steam	British	480	450
* Sea Fisher ..	,,	,,	,,	49	200
Steam Launch ..	,,	,,	—	40	—
At present on hand—					
* Coasting Vessel ..	Steel	Steam	—	530	600
* ,, ..	,,	,,	British	120	200

By Wm. Denny & Bros., Leven Ship Yard, Dumbarton.

London Belle ..	—	Steam	British	738	—
Southwark ..	—	,,	Foreign	8,607	—
Tamboft	—	,,	,,	4,361	—
Lieut. Ovzin ..	—	,,	,,	202	—
Lieut. Scourateff	—	Sail	,,	217	—
Lieut. Mexigain ..	—	Steam	,,	235	—
Electric Launch ..	—	E.L.	British	2	—
Queen Olga ..	—	Steam	Foreign	4,065	—
Prome	—	,,	British	3,580	—
Launch	—	,,	Foreign	8	—

In addition there were shipped in pieces—
Four pleasure Steamers, aggregating 2,152 tons.
One Steam Launch .. .. .. 48 ,,
Total effective H.P., 30,060.

By R. Napier & Sons, Lancefield, Glasgow.

† Yarrow	Steel	Steam	British	1,000	1,600
† Rameses	,,	,,	,,	2,500	1,800
† Lumaco	,,	,,	Foreign	750	700
† Malleco	,,	,,	,,	750	700
† John Williams ..	,,	,,	British	700	700

By Hawthorns & Co., Leith.

Huemul	—	Steam	Foreign	—	50
Columba	—	,,	British	138	30

By Fairfield Shipbuilding and Engineering Co., Ltd., Govan, Glasgow.

Lucania	Steel	Steam	British	—	—
Hound	,,	,,	,,	—	—
Royal Sovereign ..	,,	,,	,,	—	—
Hazard (Engines only)		,,	,, Admly.	—	—
Chelmsford ..	Steel	Sail	British	—	—
Garth Castle ..	(Repairs)	—	—	—	—
Normandy ..	(Repairs and new boilers)			—	—
			Total..	17,252	48,300

By Hall, Russell & Co., Aberdeen.

† Hildebrand ..	Steel	Steam	British	1,950	1,420
* Belcher	,,	,,	,,	144	320

By J. McArthur & Co., Abbotsinch, Paisley.

Ferguslie	—	Steam	British	410	350
Dolphin	—	,,	,,	97	80
Bonito	—	,,	,,	97	80
Turtle	—	,,	,,	146	170
Doon Glen ..	—	,,	,,	146	170
Kate	—	,,	,,	99	265
Parbatti	—	,,	Foreign	93	260
Ayesha	—	,,	,,	93	260

All engined by Messrs. Bow McLachlan & Co., Paisley.

IRISH.

By Workman, Clark, & Co., Ltd., Belfast.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
† Ormidale	Steel	Steam	British	3,560	2,000
Sophie Kirk ..	,,	Sail	,,	959	—
Jeanie Woodside	,,	,,	,,	962	—
* Moya	,,	Steam	,,	184	550
† Ardandhu ..	,,	,,	,,	2,091	1,600
Xantippe	,,	Sail	,,	972	—
† Ardanrose ..	,,	Steam	,,	2,091	1,600
† Ormiston	,,	,,	,,	3,562	2,000
Poltalloch ..	,,	Sail	,,	2,254	—
† Laurentian ..	Iron	Steam	,,	—	2,850

* Compound. † Triple. ‡ High Pressure.

By Harland & Wolff, Belfast.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
† Gaul	Steel	Steam	British	4,745	2,200
† Goth	„	„	„	4,738	2,200
† Orcana	„	„	„	4,802	3,100
† Sarmiento ..	„	„	„	3,603	1,900
† Mystic	„	„	„	726	1,100
† Gothic	„	„	„	7,720	4,400
† Greek	„	„	„	4,747	2,200
† Cevic	„	„	„	8,500	3,800
† Magic	„	„	„	1,630	3,500
† Sachem	„	„	„	5,204	3,000
† Magellan	„	„	„	3,590	1,900
† Inca	„	„	„	3,590	1,900
† Templemore ..	„	„	„	6,200	3,600
† Staffordshire ..	„	„	„	5,800	3,800
Dredger	„	„	„	65	40
Ionic	re-engined	only	„	—	3,000

MacIlwaine & MacColl, Ltd., Belfast.

Maria	Steel	Steam	British	2,641	1,400
Wazzan	„	„	„	1,484	1,200
North Devon ..	re-boilered	„	„	730	500
Dredger	„	„	„	—	200
Countess of Bantry	„	„	„	86	180
Launch	Steel	„	Foreign	20	—

AMERICAN.

By Union Dry Dock Co., Buffalo.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Erastus W. Day..	Wood	Steam	Amercn.	69·54	—
* Cris. Grover ..	„	„	„	56·90	—
* Wm. Kennedy ..	„	„	„	86·01	—
† Geo. J. Gould ..	Steel	„	„	2237·36	—
* Tonawanda ..	Wood	„	„	31·56	—

By Delaware River Iron Shipbuilding Works, Chester, Pa.

Priscilla	Steel	Steam	Amercn.	5,000	—
Number 58 ..	„	Sail	„	1,310	—

By Wm. Cramp & Sons, Philadelphia.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† Indiana Battleship	Steel	Steam	U. S. Ny.	10,298	9,000
† Massachusetts „	„	„	„	10,298	9,000
† Minneapolis Cruiser	„	„	„	7,475	21,000
† Columbia Yacht ..	„	„	Amercn.	225	1,800

By Maryland Steel Co., 2, Wall Street, New York.

* Dorothy	Steel	Steam	Amercn.	80	225
† Gloucester ..	„	„	„	2,542	2,300
* Baltimore.. ..	„	„	„	178	550
* Patrol	„	„	„	235	500

By Atlantic Works, East Boston, Mass.

* Cormorant ..	Wood	Steam	Amercn.	99·94	350

By F. W. Wheeler & Co., West Bay City, Mich.

† Wm. H. Gratwick	Steel	Steam	Amercn.	—	1,800
† S.S. Curry ..	„	„	„	—	2,200
† Merida	„	„	„	—	2,000
Mary E. McLachlan	Wood	Sail	„	—	—
† L. R. Doty ..	„	Steam	„	—	1,500
† George Stone ..	„	„	„	—	1,200
Ed. McWilliams..	„	Sail	„	—	—
† Centurion.. ..	Steel	Steam	„	—	2,500
Yukon	Wood	Sail	„	—	—
* Fashion	„	Steam (Tug)	„	—	150

By Chicago Shipbuilding Co., Colehour, Ill.

† Arthur Orr ..	Steel	Steam	—	2,330	1,200
† Manitou	„	„	—	2,944	1,700

* Compound. † Triple. ‡ High Pressure.

By Neafie & Levy, Shipbuilding Co., Philadelphia.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Eliz. McOwen ..	Wood	Tug	Amercn.	$62\frac{00}{100}$	160
Virginia	„	Steam	„	—	230
* W. M. Ladd (Machinery only)	„	—	„	—	460
* Long Island ..	Steel	Steam	„	$409\frac{13}{100}$	560
* Col. J. F. Gaynor	„	„	„	$151\frac{52}{100}$	500
Brigantine ..	„	„	„	$67\frac{65}{100}$	100

Steel Lighter for Cuba, without machinery.

By Detroit Dry Dock Co., Detroit, Mich.

* 114 City of Alpena	Steel	Steam	Amercn.	1,292	3,000
† 115 Mohawk ..	„	„	„	—	2,000
* 116 Cy. of Mackinac	„	„	„	1,292	3,000
117 C. A. Torman	Wood	„	„	—	—
† 118 Hry. H. Brown	Steel	„	„	Bldng.	1,800

FRENCH.

By La Cie des Messageries Maritimes, La Ciotat.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Ernest Simons ..	Steel	Steam	French	3,500	6,000

By M. P. Oriolle, Nantes.

St. Martial ..	Steel	Sail	French	10	—
* Cholchol	„	Steam	Chilian	40	120
† Margaëte	„	„	French	25	100
* Chaloupe pour le Conkin ..	„	„	„	40	100
† Marseillais No. 18	„	„	„	32	120
* Satus	„	„	„	70	100
† Ronana	„	„	Russian	105	800

By Les Chantiers, De La Seyne.

† Jauréguiberry ..	Steel	Steam	French	—	—
* Ronald	„	„	„	—	—

AUSTRIAN.

By Stabilimento Tecnico, Trieste.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
† Marquis Bacquehem	Steel	Steam	Austria	4,409	3,100
† Maria Theresia ..	„	„	„	5,200	11,000
* Sassari	„	„	Foreign	120	150
* Elena Cuppa ..	„	„	„	431	360
* Tender	„	„	Austria	43	100
* Graf Platow ..	„	„	Foreign	630	750
† Kaiserin Elisabeth	Engines	only	Austria	—	8,500
† Trieste ..	suppl	ied..	„	—	900

GERMAN.

By Bremer Schiefsbaugesellschaft, Vegesack.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
Chile	Steel	Sail	German	2,198	—
Two Coal Lighters	„	—	„	ea. 100	—
Two Lighters ..	„	—	„	ea. 125	—
Petroleum Tank Lighter ..	„	—	„	295	—
Six Mud Barges ..	„	—	„	ea. 10	—

By Schiffswerft Von Henry Koch, Lübeck.

† s.s. Brake ..	Steel	Steam	German	1,110·47	110

By Actien Gesellschaft, Neptun Schiffswerft and Maschinenfabrik, Rostock.

† Gteborg	Steel	Steam	Swedish	1,040	225
† Amrum	„	„	German	914	80
† Nordstrand ..	„	„	„	914	80
† Georg Mahn ..	„	„	„	1100·81	80
* Hamburg.. ..	„	„	„	160	60

* Compound. † Triple. ‡ High Pressure.

By Flensburger Schiffsbau Gesellschaft, Flensburg.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† Electra	Steel	Steam	German	1,268	500
† Hebdomos	,,	,,	,,	1,265	500
† Progress	,,	,,	,,	1,098	450
† Johanna	,,	,,	,,	1,280	500
† Taygeta	,,	,,	,,	1,284	500
† H. A. Nolze	,,	,,	,,	736	300
† Modestia	,,	,,	,,	3,810	1,600
† Brunhilde	,,	,,	,,	1,881	500
† Marienburg	,,	,,	,,	2,240	1,100
S. No. 145	,,	Ice breaker	,,	25	—
† S. S. No. 144	,,	Steam	,,	2,240	1,100

By Howaldtswerke, Kiel.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† 1° de Mayo	Steel	Steam	Arg'tine	905·02	650
* Swentine Dock, II.	Steel and wood composition.	—	German	—	32
† Prinz Waldemar	Steel	Steam	,,	685·22	1,200
* Dampflagger No. VI	,,	,,	,,	445·68	260
* Amstel	,,	,,	Dutch	590·37	300
† Stephanie	,,	,,	Austrian	100·77	180
† Lussin	,,	,,	,,	252·94	260
* Legalidade	,,	,,	Brazil'n	178·80	120
† Farrajro	,,	,,	,,	206·92	300
No. 274, 275 Hopper, Barges	,,	—	,,	—	—
† No. 276 (not yet named)	,,	Steam	German	—	250
† No. 277 (not yet named)	,,	,,	,,	—	250
† Colonias	,,	,,	,,	713·70	500
* Fliege	,,	,,	,,	10·37	22
No. 282 A 5, Barge	,,	—	,,	47·46	—
† No. 284 (not yet named)	,,	,,	,,	—	100

By Reiherstieg Schiffswerfte, und Maschinenfabrik, Hamburg.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† Kaleitongas	Steel	Steam	German	2,373	1,000
Seel (*)	,,	Sail	,,	500	—
Veste (*)	,,	,,	,,	500	—
† Irene	,,	Steam	,,	3,466	1,600

* These two vessels are large cargo lighters.

By J. W. Klawitter, Danzig.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
* Auguste	Steel	Steam	German	—	100
† Schwarzwasser	,,	,,	,,	—	550
* Vulkan	,,	,,	Russian	—	200
* Blitz	,,	,,	,,	—	250

By Gebruder Sachsenberg, Gesellschaft mit beschränkter Haftung, Rosslau, Elbe, Anhalt.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
* Paico	Steel	Steam	Foreign	22	25
* Garibaldi	,,	,,	,,	65	120
* Boa Vista	,,	,,	,,	65	120
† Ruhrort VII.	,,	,,	German	600	900
Dahme	,,	Pet'm	,,	9	12
* Curityba	,,	Steam	Foreign	35	50
† Belgrad	,,	,,	,,	400	900
* Prinz Heinrich	,,	,,	German	140	200
* Deutschland	,,	,,	,,	210	300
* Staar	,,	,,	,,	12	20
* Santa Cruz	,,	,,	Foreign	75	120
Friederike	,,	Sail	German	800	—

NORWAY.

By Bergens Mekaniska Verksted, A.B., Bergen.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† John Wilson	Steel	Steam	Norweg.	806	120
† Colombia	,,	,,	,,	806	120
* Anna	Iron	,,	,,	15	8

* Compound. † Triple. ‡ High Pressure.

ITALIAN.

By Geo. Ansaldo & Co., Sestri, Ponente.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
† 142 Schichau	Steel	Tor. bt	Italian	82·71	1,000
† 143 ,,	,,	,,	,,	82·71	1,000
† 144 ,,	,,	,,	,,	82·71	1,000
* Conte di San Robert	,,	S. Tug	,,	48·97	120
* General Cavalli	,,	,,	,,	48·97	120
* General Valfré	,,	,,	,,	48·97	120
† Liguria	,,	Cruis'r	,,	1703·25	7,200
Rio Grande	,,	Schn'r	,,	419·00	—
† Sarita	,,	Steam	,,	695·81	680

By Cantiere Poli, Chioggia (Venice).

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
San Domenico	Steel	Sail	Italian	1,120	—

BELGIUM.

By Societe Anonyme John Cockerill, Hoboken.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
* No. 333	Steel	Steam	Belgian	—	250
* ,, 334	,,	,,	,,	—	500
‡ ,, 335	Steel Galv.	,,	,,	—	52
CLVIII	Steel	Armr.	,,	—	3 l'nchs
CLIX	,,	,,	,,	—	3 ,,
CLX	,,	,,	,,	—	1 ,,
CLXI	,,	,,	,,	—	1 ,,
CLXII	,,	,,	,,	—	1 ,,
CLXIII	,,	,,	,,	—	1 brge.
CLXIV	,,	,,	,,	—	,,
CLXV	,,	,,	,,	—	,,
CLXVI	,,	,,	,,	—	,,
CLXVII	,,	,,	,,	—	,,
CLXVIII	,,	,,	,,	—	,,
CLXIX	,,	,,	,,	—	,,
CLXX	,,	,,	,,	—	,,
CLXXI	,,	,,	,,	(ponton)	—

SWEDEN.

By Kockums Mekaniska, Werkstad, Malmo.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Voin	Steel	Sail	Russia	1,072	100
* Ali Dadascheff	,,	Steam	,,	541	90
* Puschkin	,,	,,	,,	1,043	200

By W. Lindbergs Verkstads och Varfs Aktiebolag, Stockholm.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
* Nasser-Ed-Din Schah	Steel	Steam	Foreign	81	30
* Gefion	,,	,,	Swedish	30	16
* Narova	,,	,,	Foreign	25	12
* Saltsjöbaden I.	,,	,,	Swedish	79	14
* ,, II.	,,	,,	,,	79	14
Svinbadan Lgtship.	,,	,,	,,	205	45

DENMARK.

By Burmeister & Wains, Copenhagen.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Frode	Steel	Steam	Danish	2,060	200
† Danmark	,,	,,	,,	2,060	200
* Soderhamn	,,	,,	German	811	120
‡ Ulfsund	,,	,,	Danish	31	12
* Fremad	,,	,,	,,	80	50

By Elsinore Iron Shipbuilding and Engineering Co., Elsinore.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
* Expres	Steel	Steam	Danish	44	22
Prinsesse Marie	,,	Sail	,,	1,408	—
* Nerma	,,	Steam	,,	732	90
† Virgo	,,	,,	Foreign	445	70
* Syr	,,	,,	Danish	520	220

* Compound. † Triple. ‡ High Pressure.

HOLLAND.

By Werf Conrad, Ltd., Haarlem.

	Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
*	Vizcaya	Steel	Steam Hop'r	Bilbao Harb.Tr.	320	75
*	Simson & Goliath	,,	Dre'g.	Prussian	285	100
*	Wolga, 1 and 2 ..	,,	,,	Russia	300	90
*	Borcea	,,	Dre'g.		160	30
*	Tobol, 1	,,	,,	Russia	300	90
*	Liban, 1, 2 and 3..	,,	Steam Hop'r	,,	360	80
	Castor	,,	barges	French	200	—
	Pollux	,,	towing	,,	200	—
	5 Barges	,,	,,	Spanish	100 ea.	—
	3 Barges	,,	,,	Dutch.	60 ea.	—

By Nederlandshe Stoomboot Maatschappy, Rotterdam.

	Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
*	Alkmaar Packet VI.	Steel	Steam	Dutch	250	200
*	Stad Kampen ..	,,	,,	,,	274	200
*	Chicago	,,	,,	French	257	210
*	Keizersveer II. ..	,,	,,	Dutch	57	105

By Royal Shipbuilding & Engineering Co., De Schelde, Flushing.

	Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
†	Argus	Steel	Steam	Dutch	362	1,700
†	Cycloop	,,	,,	,,	362	1,700

FINLAND.

By Wm. Crichton & Co., Aktiebolag, Abo.

	Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
‡	Cutter No. 1 ..	Steel	Steam	Russian	14	10
*	,, No. 2 ..	,,	,,	,,	20	15
*	Lightship	Iron	,,	Liban	190	75
†	Vsadnik	Steel	,,	Russian	3,850	800
†	Guoddmak ..	,,	,,	,,	3,850	800
‡	Steam Launch ..	Wood	,,	Finland	10	6
*	Cutter No. 3 ..	,,	,,	Russian	6	6
*	Siamaa	Steel	,,	Finland	75	40
*	Paddle Boat ..	,,	Padle.	Russian	94	40

ENGLISH.

By Edwards & Symes, Millwall.

	Name of Vessel.	Built of	Steam	Owners.	G. T. Regis.	H. P. N.
	Tyne	Iron	Sail	British	100	—
	Tees	,,	,,	,,	100	—
	Diving Bell ..	Steel	,,	Egypti'n	50	—
	Lincoln	Iron	,,	British	30	--
	Hopper	Steel	,,	Brazilan	40	—
*	Ida..	,,	Steam	Colonial	100	40
‡	Ella	,,	,,	,,	40	30
	No. 304	Iron	Sail	Brazilan	40	—
	No. 305	,,	,,	British	40	—
	No. 306	,,	,,	,,	60	—
*	No. 308	Steel	Steam	Colonial	150	50

* Compound. † Triple. ‡ High Pressure.

Centreboards.—At a meeting of the members of the London Sailing Club, on December 16th, a paper was read by Mr. Dixon Kemp upon centreboards. He showed by means of diagrams on a blackboard how the lateral resistance of an ordinary keel might be masked by the lee bilge of the vessel, while a centreboard would escape this danger. A triangular board was, in his opinion, the most effective, and he enunciated the theory, that only the leading end of a rectangular board was effective for lateral resistance. A centreboard was, of course, most effective in the case of a vessel of small draught and great beam; but centreboard sailors, especially upon such a river as the Thames, must always remember that the surface velocity of a tide differed from the velocity at various depths below the surface, and must use or eschew their centreboards accordingly.

Summary of Shipbuilding Returns of United Kingdom in 1893, arranged in order of Tonnage, built by each Firm.

	Name of Firm.	Place.	No. of Ships.	Total Tons.
1	Harland & Wolff..............	Belfast	15	65,660
2	Wm. Gray & Co..............	Hartlepool	18	50,849
3	Russell & Co..............	Clyde	27	47,093
4	J. L. Thompson & Sons......	Wear	12	32,441
5	C. S. Swan & Hunter.........	Tyne	9	31,088
6	Ropner & Sons..............	Tees	11	28,436
7	Sir Baylton Dixon & Co.......	Tees	16	26,612
8	A. Stephen & Sons...........	Clyde	7	26,230
9	James Laing..............	Wear	8	25,384
10	Sir Wm. Armstrong, Mitchell & Co..............	Tyne	7	25,260
11	Richardson, Duck & Co.......	Tees	16	24,679
12	Wm. Denny & Bros............	Clyde	15	24,210
13	Short Bros..............	Wear	9	23,521
14	J. & G. Thomson..............	Clyde	6	21,852
15	Charles Connell & Co..........	Clyde	9	20,060
16	Naval Construction & A. Co	Barrow	7	19,552
17	Palmer's Shipbuilding Co....	Tyne	7	19,543
18	J. Readhead & Sons.......	Tyne	7	18,036
19	Wigham Richardson & Co. ..	Tyne	7	17,853
20	Fairfield Shipbuilding Co....	Clyde	4	17,252
21	Workman, Clark & Co.......	Belfast	9	16,635
22	Furness, Withy & Co.........	Hartlepool	6	16,292
23	Barclay, Curle & Co...........	Clyde	9	14,268
24	A. McMillan & Sons.........	Clyde	9	13,153
25	R. & W. Hawthorn, Leslie & Co..............	Tyne	2	11,100
26	D. & W. Henderson & Co....	Clyde	8	10,723
27	Craig, Taylor & Co...........	Tees	4	9,376
28	David J. Dunlop & Co..........	Clyde	4	8,850
29	Tyne Iron Shipbuilding Co.	Tyne	3	8,144
30	John Blumer & Co..........	Wear	4	8,065
31	W. Dobson & Co............	Tyne	5	7,740
32	Sunderland Shipbuilding Co.	Wear	4	7,735
33	A. & J. Inglis..............	Clyde	6	6,556
34	Bartram, Haswell & Co.......	Wear	2	6,219
35	Lobnitz & Co............	Renfrew	13	5,808
36	Ailsa Shipbuilding Co.......	Troon	5	5,749
37	R. Napier & Sons..............	Clyde	5	5,700
38	Grangemouth Dockyard Co.	Grangemouth	5	5,281
39	Ramage & Ferguson.........	Leith	4	5,192
40	Fleming & Ferguson........	Paisley	7	5,180
41	S. P. Austin & Co...........	Wear	3	5,097
42	Simons & Co..............	Clyde	8	5,040
43	Gourlay Bros..............	Dundee	3	4,780
44	John Priestman & Co..........	Wear	2	4,748
45	Scott & Co..............	Greenock	9	4,696
46	Earle's Shipbuilding Co......	Humber	10	4,518
47	Laird Bros..............	Mersey	5	4,382
48	Wm. Doxford & Son, Ltd...	Wear	2	4,370
49	Caird & Co..............	Clyde	1	4,319
50	McIlwaine & MacColl, Ltd...	Belfast	3	4,145
51	R. Duncan & Co..............	Clyde	2	3,896
52	Williamson & Son...........	Workington	5	3,617
53	Ritson & Co..............	Maryport	3	3,606
54	Wood, Skinner & Co..........	Tyne	4	2,889
55	Mackie & Thompson..........	Clyde	16	2,867
56	Thos. Roydon & Sons.........	Mersey	1	2,846
57	T. Turnbull & Son..........	Whitby	1	2,784
58	Napier Shanks & Bell........	Clyde	3	2,524
59	Campbeltown Shipbdg. Co.	Campbeltown	2	2,493
60	Wm. Harkess & Son..........	Tees	3	2,460
61	Edwards' Shipbuilding Co.	Tyne	1	2,325
62	R. Craggs & Son..............	Tees	6	2,352
63	Cook, Welton & Gemmell..	Humber	17	2,285
64	London & Glasgow Shipbuilding Co..............	Clyde	1	2,240
65	W. Pickersgill & Sons.........	Wear	2	2,222
66	Wm. Hamilton & Co.........	Clyde	3	2,211
67	Blyth Shipbuilding Co., Ltd.	Blyth	1	2,147
98	Cochrane & Cooper...........	Beverley	15	2,123
69	Murdoch & Murray............	Clyde	6	2,118
70	Hall, Russell & Co.	Aberdeen	2	2,094

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from November 27th to December 18th, 1893:—

Anderson, Arthur R., engineer to the *Surprise*, to date November 29th.

Ayres, Robert B., engineer to the *Vivid*, to date November 30th.

Ball, Ralph H. E., engineer to the *Mersey*, to date November 24th.

Bench, George E., chief engineer to the *Victory*, additional, to date December 5th.

Blake, Albert V., engineer to the *Victory*, additional, to date December 9th.

Bourke, Henry G., fleet engineer to the *Victory*, additional, to date December 9th.

Canter, W. J., fleet engineer, has been promoted to the rank of Inspector of Machinery in Her Majesty's fleet.

Dawson, John, assistant engineer to the *Blake*, additional, to date December 1st.

Donohue, Robert W., engineer to the *Mohawk*, to date December 1st.

Drought, Arthur E. (probationary), assistant engineer to the *Trafalgar*, to date November 29th.

Ellis, Joseph H. W. N., chief engineer to the *President*, additional, to date December 5th.

Frost, J. J., chief engineer, has been advanced to the rank of staff engineer in Her Majesty's fleet.

Gibson-Sugar, John S., engineer to the *Vernon*, additional, to date November 24th.

Green, T., chief engineer, has been advanced to the rank of staff engineer in Her Majesty's fleet.

Gregory, Charles W., chief engineer to the *Mohawk*, undated.

Ham, S., assistant engineer, has been advanced to the rank of engineer in Her Majesty's fleet.

Hammond, Cyril E. J. (probationary), assistant engineer to the *Phœbe*, additional, to date November 25th.

Harding, Charles A., engineer to the *President*, additional, to date November 30th.

Harding, William J., fleet engineer to the *President*, additional, to date December 5th.

Hay, Charles J., engineer to the *Mohawk*, to date December 11th.

Hender, William J., engineer to the *President*, additional, to date November 30th.

Herbert, R. K., engineer to the *Revenge*, to date December 11th.

Hooken, William F., engineer to the *Vivid*, for the *Hussar*, to date December 6th.

Hole, J. W., chief engineer, has been advanced to the rank of staff engineer in Her Majesty's fleet.

James, C. J., engineer to the *Havock*, to date December 11th.

Jenkins, J. E., engineer, has been promoted to the rank of chief engineer in Her Majesty's fleet.

Johnson, William C., assistant engineer to the *Sans Pareil*, to date November 29th.

Laird, George F., staff engineer to the *Raleigh*, to date December 9th.

Langmaid, Joseph, staff engineer to the *Rupert*, additional, to date December 5th.

Littlejohns, William G., inspector of machinery to the *Pembroke*, additional, to date October 15th.

Marrack, Philip, engineer to the *Euphrates*, to date November 30th.

Moore, Walter L. (probationary), assistant engineer to the *Vivid*, to date December 13th.

Morrison, Richard B., assistant engineer to the *Amphion*, to date November 29th.

Mortimer, John E., engineer to the *Penelope*, to date November 24th.

Moysey, William H. S., engineer to the *Himalaya*, to date November 30th.

Olver, Arthur, assistant engineer to the *Nile*, to date November 29th.

Parker, William R., engineer to the *Gleaner*, to date December 5th.

Ryan, Richard, assistant engineer to the *Gleaner*, to date December 5th.

Simpson, James M., engineer to the *Victory*, additional, to date November 25th.

Slade, A. H., engineer, has been promoted to the rank of chief engineer in Her Majesty's fleet.

Stewart, William F., chief engineer to the *Sandfly*, undated.

Stuart, J. J., chief engineer, been advanced to the rank of staff engineer in Her Majesty's fleet.

Taylor, Ernest J., engineer to the *Pembroke*, additional, to date November 30th.

Toop, William, engineer to the *Cambridge*, additional, to date November 29th.

Turner, Arthur William, chief engineer to the *Vivid*, additional, to date November 15th.

Walker, James J., staff engineer to the *Cyclops*, to date December 1st.

Ward, E. V. (probationary), assistant engineer to the *Pembroke*, additional, to date December 1st.

Wheatley, George E., engineer to the *Cockatrice*, to date November 24th.

White, William W., chief engineer to the *Vivid*, additional, to date December 5th.

HOAR & BROWN'S HARDWOOD MARKET REPORT, DECEMBER 16th, 1893.

Teak.—Old stocks, which have depressed prices for such a long period, are now being worked off rapidly, and when cleared up will leave the market in a better position than it has occupied lately.

Other strengthening features are the Admiralty requisitions already put forward, amounting to about 9,000 loads, and their prospective requirements which it is possible may closely follow the agitation now being pressed forward from all sides for an increase of our naval strength.

There are two cargoes now in course of discharge, one from Moulmein and one from Rangoon, which may be described as of fair average quality, and will no doubt with the turn of the year find a ready market. Reviewing the position generally, it is a pleasure to be able to report a very much healthier tone.

Planks continue to arrive far in excess of the demand, and prices in consequence are still ruling very low.

Mahogany.—Public sales are not meeting with the usual support from the merchants and consumers in consequence of the preponderance of wood forced upon the market without regard to the depression in value which must necessarily follow.

At the late without reserve sales prices touched the lowest figure which has been known for very many years. The logs were of inferior character, and parcels such as these should be worked off privately, as the unusually low quotations render other legitimate business very difficult.

At the moment there is little doing on account of the approaching holidays, and any more forcing would lead to a further decline.

In Cuba stock values are exceptionally low and prime quality logs are being offered at prices rarely equalled during the last quarter of a century, but sales are slow, as is always the case when these extreme figures are ruling.

Cedar.—Some considerable shipments have arrived and more are expected. There is little or no business doing, buyers preferring to wait until the market gets fully stocked before replenishing.

Kawrie Pine.—Prices have advanced slightly as stocks decrease and Quebec Pine becomes more scarce. Sales are not very frequent and there is plenty of wood here to supply present requirements.

Sequoia.—Low figures are the rule, as some forcing has taken place. Sales are unusually quiet in the ordinary channels, but perhaps another without reserve sale would stimulate buyers.

Padouk.—A shipment of what is termed Moulmein Padouk has just been piled away and is now offering for sale, but the quality is very different to that of the parcels arriving from the Andaman Islands, which have lately been finding such favour among consumers.

Russian Cruisers.—There has lately been commenced at the Baltic Shipbuilding Yard, St. Petersburg, two new cruisers of the *Rurik* type. The dimensions of one vessel will be—length 480ft., breadth 68½ft., depth 25ft., and 12,130 tons burden, the other is to be 446ft. in length, 70ft. in breadth, 27ft. in depth, and 12,095 tons burden. The speed of both cruisers will be about 19 knots. Their armaments will consist of 40 guns of various types, and six torpedo apparatus.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(From our own Correspondent.)

BY the time these few Notes are in the hands of our readers the year 1893 will be a thing of the past, and the new year will have been commenced with feelings of hope in the future. It is usual at this time to look back on the work completed during the year just past, and also to compare the work on hand at this period with that on hand at the beginning of the past year, and with regard to this latter we find that whilst the tonnage on hand was roughly estimated last year, at the same date, at 190,000 tons, this year we have close on 180,000 tons, and if these figures can be taken as a guide at all, we will certainly not experience the same sudden collapse as occurred in the year 1885, when the output fell from 296,000 tons to 193,000 tons. The smallness of outputs has not been in one district, but over all the various yards, and may be seen at a glance from the following comparative table:—

	1893.		1892.	
	Vess.	Tons.	Vess.	Tons.
Clyde............	206	261,956	350	336,414
Forth............	12	10,256	32	33,653
Tay	7	6,707	16	22,290
Dee	4	2,415	13	3,414
Totals ...	229	281,334	411	359,771

The most striking feature, of course, is the extraordinary difference in the number of vessels, compared to the difference in tonnage, and this points to the fact that every year we are building our vessels larger and larger, and the question of the near future will be one of dredging, deepening, and widening the harbours and docks round our coasts, and Scotland has already shown the way by her Cessnock Docks on the Clyde, and the new docks in course of construction at Leith.

Amongst the notable vessels launched, and their builders, we have *Lucania*, by the Fairfield Co.; the two Royal Mail boats by Messrs. J. & G. Thomson (Clyde Bank); the *Leopold II.*, which when launched was claimed by her builders, Messrs. Denny & Co., as the fastest paddle steamer in the world. Messrs. Alex. Stephen & Sons, Linthouse, also deserve mention for the exceptional size of the vessels (mostly cargo, however) launched by them. In marine engineering a lot of work has been done, and sailing tonnage, which was so much in evidence last year, is forced to "take a back seat." Repair work, though not plentiful, has been in evidence in a quiet way, and in order to cope with this class of work in the coming years new graving docks are progressing, whilst repairing slips are growing into favour. At Port-Glasgow that "never to be beat" firm, Messrs. Blackwood & Gordon, have completed a new hauling-up repairing slip, fully 700 ft. long, and capable of taking up vessels of 1,500 tons weight. The steel carriage, hauling-up gear, engines, and boilers are all constructed by themselves, and point to the "go-ahead" principles of these builders. In the repair line Messrs. A. & J. Inglis, Pointhouse, have had a very large share, and though they are not responsible for much new tonnage this year, their prospects for 1894 are as bright as any in Scotland. On the East Coast Messrs. John Cran & Co., who of recent years have come strongly to the front, can claim to have secured a very fair share of repair business, a class of work for which the port of Leith is now justly pre-eminent. Whilst on the Forth we are glad to see that the old town of Inverkeithing is likely to hear the hammers plying in the future, and a trade so long abandoned will do much by its return to increase the prosperity of the most picturesque shipbuilding port in Scotland. To return to hard facts and figures, a correct idea of the fluctuations of the shipbuilding trade in Scotland during the past 30 years will be obtained from the following table:—

1893 ...	281,334	1887 ...	185,362
1892 ...	336,414	1886 ...	172,440
1891 ...	326,475	1885 ...	193,453
1890 ...	349,995	1884 ...	296,854
1889 ...	335,201	1883 ...	419,664
1888 ...	280,037	1882 ...	391,934
1881 ...	341,022	1872 ...	230,347
1880 ...	241,114	1871 ...	196,229
1879 ..	174,750	1870 ...	186,401
1878 ...	222,353	1869 ...	192,310
1877 ...	160,710	1868 ..	169,571
1876 ...	174,824	1867 ...	108,024
1875 ...	211,824	1866 ...	124,513
1874 ...	262,430	1865 ..	153,932
1873 ...	232,926	1864 ...	178,505

Strikes have, unfortunately, been rather frequent during the past twelve months, and have been of a most serious nature. Of course it seems to be only natural nowadays that when trade begins to take a downward course, disagreements occur between masters and men, and as both consider themselves the stronger body a strike or lock-out is bound to occur. As the subject of strikes has provided a heading for every daily paper for the past three months we will give it a rest, but cannot refrain from expressing the fear that the postponement of the Scotch coal strike till February is very likely to cause a severe blow to the trades concerned just when an upward turn is about to occur, and we sincerely recommend a more conciliatory tone being used when next masters and men meet to discuss their mutual welfare. As is only expected at the close of a rather dull year, very few new orders have been placed, but those that have been have gone to the quarters where they were most needed. Messrs. Charles Connell & Co., Whiteinch, have booked a new cargo steamer of about 3,000 tons. The Blyth Shipbuilding Co. have contracted to build two screw-steamers of 3,600 tons each, and Messrs. Russell & Co. have contracted to build two sailing ships of 2,750 tons each for Glasgow owners. This latter firm have a large quantity of tonnage on hand and figure well in the output column, in the earlier part of this issue. Messrs. Brown Brothers & Co., Rosebank, Edinburgh, received during the month a large order for their special class of machinery, from the Chinese Government. Messrs Hall-Brown, Buttery & Co., Govan, booked the order for a good quantity of high speed power for the electric lighting of large premises in Aberdeen, and as this young firm are making a speciality of high speed work, and are to our knowledge the only Scotch firm who have tackled it, we do not see why their individuality should not meet with extensive favour from the Scotch shipbuilders, &c.

The end of the year of course sees a considerable hurry on the part of several firms to get tonnage into the water and bring up the output, but even with this hurry the yards present a decidedly more flourishing look than they had this time last year. The London and Glasgow Shipbuilding and Engineering Co. have two large steamers well in hand, whilst next to them Messrs. Mackie & Thomson have four vessels, of various sizes, rapidly approaching completion. Messrs. A. & G. Inglis have three large vessels laid down, whilst their slips are well occupied with repair work. Messrs. D. & W. Henderson have three steamers in frames, and have launched a very handsome steam yacht this month. The Fairfield yard will soon have a blank appearance when the large liner, *Tantallon Castle*, leaves the ways, as they have only a small steamer laid down yet, but their work on hand is almost ready for the blocks. As has been the case all this year, the Linthouse yard is the busiest in the upper reaches, and their output, which is not beside me at present, will be one of the largest in the district. The Whiteinch side of the river is also fairly brisk, and a couple of launches will take place very soon. In the Greenock district, Messrs. Russell & Co. are to the fore, whilst Scott & Co., and Messrs. Caird, are not far behind. Port-Glasgow is making all the show it can, but more orders to follow on with would not be missed. It is useless to enumerate the various districts, suffice to say that 1894 is entered upon, actually, though not by figures, still by prospects, with a better and more prosperous feeling than the year just past.

We hope in next Notes to give some idea of the advance in the progress of the new docks, both here and on the East Coast, as space will not permit of our doing so in this issue.

The London & Glasgow Co., Govan, have four steamers on the stocks of an aggregate gross tonnage of 15,500 tons. Messrs. John Shearer & Son, Kelvinhaugh, have on hand a steamer of 500 tons for Glasgow, and one of 120 for Belfast. The Fairfield Co. have three vessels on the stocks—a large single screw-steamer for the Castle Line, a fast paddle-steamer for the Thames, and a twin-screw yacht for Captain H. L. B. M'Calmont. On the stocks at Messrs. Barclay, Curle & Co.'s, Whiteinch, are two vessels—a tug for the Admiralty, and a cargo steamer of 3,300 tons for the Castle Line. Messrs. Simons &

Co., Renfrew, have on hand two hopper dredgers—one of 350 tons for Australia, and one of 700 tons for the Russian Government. The most important of the Paisley contracts in progress is probably the construction of two torpedo-boat destroyers by the Abercorn Shipbuilding Co. Messrs. Denny & Brothers, Dumbarton, who have generally something better than the average to go on with, are engaged on a twin-screw steamer for the Fleetwood-Belfast service; an almost similar ship for the South Coast; and a paddle-steamer for the Canadian Pacific Railway Co. Messrs. D. J. Dunlop & Co., Port Glasgow, have on hand two steamers of 5,300 tons; and Messrs. Blackwood & Gordon one of 1,300 tons for the City of Dublin Steam Packet Co. The other work is, with a few exceptions, of the ordinary class. From the employers' point of view prospects are poor; unless matters mend and workmen become more reasonable in their demands, 1894 will be only, they say, a repetition of the past year. And 1893 was bad enough they think. What with a demarcation quarrel between the "white squads," an attempt of the joiners to make overtime in certain circumstances operative immediately on the expiry of short time, occasional accesses of unreason in the case of at least two important sections of Mr. Knight's society; and latterly the scarcity of fuel through the strike of miners—the members of the Clyde Employers' Association had a good deal more than their share of the year's worry. On the Forth the work on hand may be put down roughly at 11,500 tons, whilst on the Tay there are six vessels of 7,400 tons still on contract. From these returns we are safe to assume that trade for 1894 will certainly not be worse in Scotland than it has been during the past twelve months.

In the marine engineering shops on the Clyde the machinery completed compares rather favourably with that of last year, being 256,545 H.P. against 279,564. This shows a much smaller decrease than has been experienced in the shipyards, but may be accounted for by the increased power now used in all vessels. The number of sets was not given us in every instance, but the total is made up of 58 sets of compound, 112 of triple, and 7 of quadruple, and the distribution may be seen from the following table:—

	Sets.	1893. I.H.P.	1892. I.H.P.
Fairfield Company, Govan	6	48,300	31,551
Jas. & Geo. Thomson (Ltd.), Clydebank	10	42,100	19,750
Wm. Denny & Co., Dumbarton	16	30,060	20,000
A. Stephen & Sons, Linthouse	7	16,950	7,740
Muir & Houston, Kinning Park	31	14,500	13,150
Dunsmuir & Jackson, Govan	11	10,130	11,050
D. Rowan & Son, Finnieston	11	9,975	9,800
Fleming & Ferguson, Paisley	13	9,400	8,000
D. & W. Henderson, Partick	5	9,000	11,200
Ross & Duncan	26	7,525	5,485
Bow, M'Lachlan & Co., Paisley	—	7,450	9,151
Hutson & Son, Kelvinhaugh	7	7,250	10,450
D. J. Dunlop & Co., Port-Glasgow	5	7,200	3,150
A. & J. Inglis, Pointhouse	5	6,785	7,470
Wm. Simons & Co., Renfrew	11	6,320	7,170
R. Napier & Sons, Govan	5	5,500	15,500
Lobnitz & Co., Renfrew	9	3,840	7,253
Barclay, Curle & Co. (Ltd.), Whiteinch	5	3,700	800
London & Glasgow Co., (Ltd.), Govan	1	3,240	1,650
Caird & Co. (Ltd.), Greenock	1	3,000	31,080
Scott & Co., Greenock	5	2,620	34,300
Rankin & Blackmore, Greenock	4	700	3,200
Blackwood & Gordon, Port-Glasgow	—	—	600
Minor firms	—	1,000	10,144
		256,545	279,564

Fairfield, with the *Lucania's* engines included, of course, heads the list; whilst Messrs. J. & G. Thomson, Limited, come pretty close, followed at some distance by Messrs. Denny. A considerable drop then takes place to Messrs. A. Stephen & Sons, and from here the outputs gradually taper off.

James Howden & Co., Glasgow, have given up the construction of marine engines and boilers. Beyond designing and constructing screw propellers, of which they make a speciality, they restrict their manufacturing operations to the details of their system of forced draught—fans, fan engines, &c.—and supply them to engineers constructing engines and boilers for steamships using the system, which is now very extensively used in the Mercantile Marine. They booked orders during 1893 for its application, under royalties, to 52 steamships, mostly of large size, including the large passenger steamers now building at Philadelphia for the American Line by Messrs. Cramp & Sons. The aggregate power of these 52 steamships is 145,600 I.H.P. The new steamer *Gothic*, completed for the White Star Line by Messrs. Harland & Wolff, Limited, Belfast, is fitted with the Howden system of forced draught. The *Gothic*, however, is not included in the above-mentioned list, having been entered in 1892.

TRADE NOTES FROM THE TYNE, WEAR, TEES, HARTLEPOOLS, &c.

(*From our own Correspondent.*)

THE TYNE.

THE tonnage launched at the various centres of shipbuilding on the North-East Coast during the year just expiring, has proved to be much smaller in quantity than the output of the preceding twelve months. This is in accordance with the expectation formed in business circles at the beginning of the year, and which was given expression to in the issue of the MARINE ENGINEER for January. There was indeed good reason to harbour gloomy anticipations regarding the work of the year at the time spoken of; for a large proportion of the building berths were without occupants, the docks and rivers were crowded with unemployed shipping, and it was a matter of common knowledge that enquiries for new tonnage were as rare as the proverbial angels' visits. In the first six months of the year the tonnage launched was inconsiderable, there having been only eight vessels put into the water from the North-East Coast yards during the month of January, two of which were launched on the Tyne. Messrs. C. S. Swan & Hunter made the first contribution to the present year's output, by putting into the water a vessel intended for the "Prince" Line, and as they commenced well, so also have they ended, as the result of the year's operations places them at the head of the Tyneside firms in the matter of tonnage launched. The only other Tyne firm which launched in January was Messrs. John Readhead & Sons, South Shields, the vessel in this case having been ordered by the Cambay Steam Shipping Co., of Newcastle. Of the other six vessels, two were launched at Hartlepool, namely, from the establishments of Messrs. Furness, Withey & Co., and Messrs. Wm. Gray & Co.; two on the Tees, from the yards of Messrs. Ropner & Son, Messrs. Raylton Dixon & Co.; and two at Sunderland by Messrs. Short Bros., and Mr. James Laing. As the year advanced, launches became more numerous, but there was a very marked scarcity of new orders for successors to the vessels put off the stocks, and hence the substantial decline in the aggregate amount of tonnage launched during the year, as compared with the output of the previous year. On the Tyne, the decrease of output in 1893, as compared with 1892, is 59,691 tons, while on the Wear the decrease is still more considerable, reaching the large figure of 64,264 tons. At the Hartlepools the decrease of output amounts to 24,283 tons, and at Whitby, where, it may be observed, there is but one building yard, that of Messrs. T. Turnbull & Son, the decline is 10,423 tons. The output for the year at the Blyth yards shows a reduction of 5,845 tons, as compared with the output in 1892, and at Middlesboro' there is also a substantial decrease. Stockton is, we believe, the only shipbuilding centre which has turned out more tonnage in 1893 than in 1892; but the difference is but trifling, and does not materially affect the general result, the figures representing the output for the two years respectively being 62,000 and 61,000 tons. Putting together the whole of the figures representing the proportions of decrease at the different centres, we find that the decline of shipbuilding on the North-East Coast from Whitby to Blyth inclusive, amounts to the large total of 164,776 tons. It may be convenient to give here the figures showing the output in 1893 and also in 1892, at each centre of the important districts indicated, so that the relative effect of the trade depression at the different seats of shipbuilding may be the more readily seen:—

	1893.	1892.	Decrease.
The Tyne	147,249	207,210	59,961
The Wear	126,511	190,775	64,264
Hartlepool	66,641	90,924	24,283
Whitby	2,784	13,207	10,423
Blyth	2,226	8,071	5,845
	345,411	510,187	164,776

From this it will be noted that the falling off has been pretty equally distributed, the somewhat isolated ports of Blyth and Whitby showing the largest declension. It should be stated, however, that the Blyth Shipbuilding Co. have a vessel of 2,500 tons ready for launching, and if this had been included the record of work turned out at that port would have been more satisfactory.

To Messrs. Wm. Gray & Co., of West Hartlepool, belongs the distinction this year as well as last, of being first on the list of builders as regards the amount of tonnage launched, the quantity put off from the two yards belonging to this firm being 50,349 tons. Last year (1892), the record of tonnage built by this firm was 59,810 tons, and for 1891, it was 59,033 tons. In the matter of productive capacity, or at all events in results achieved, this firm is only beaten by Messrs. Harland & Wolff, of Belfast, and there cannot be a question that when the competition of the whole United Kingdom is to be reckoned with, it is no small honour to take second place. On the Tyne Messrs. Swan & Hunter take first position with an output of 31,088 tons, and on the Wear, Messrs. J. L. Thompson & Sons hold the premier place with an output of 32,441 tons. In proportion to the number of their building berths it is probable that the last named firm have done as well in the matter of output as any in the kingdom.

Among the interesting events in connection with shipbuilding that have occurred on the Tyne during the year, was the departure of the battleship *Resolution* from the Jarrow yard, her sister ship, the *Revenge* having preceded her by some months. The launching of the large pontoon for the Manchester Ship Canal, from the yard of the Edwards' Shipbuilding Co., was also an event of some significance, especially as there is a probability that other work of the same kind may find its way to the district. The re-opening of the Scotswood yard, after a prolonged stoppage, was another event worth noting, and the completion of the large graving dock connected with the works of the Wallsend Slipway Engineering Co. may also be regarded as among the principal achievements of the year. Messrs. C. S. Swan & Hunter have made considerable extension with a view to facilitate the carrying on of work in certain departments of their establishment, and the Tyne Shipbuilding Co. have added to their premises a commodious range of new offices. At Messrs. Readhead's yard an important change has been effected by the lengthening of the building berths, which enables the firm to undertake the construction of very large vessels. Most leading firms in the district have taken advantage of the comparatively dull period to make necessary changes in their productive arrangements, by putting down new plant, &c., so as to be able to cope even more effectually than hitherto with any exceptional pressure of work which may arise in the future.

Shipbuilding.—So far as work prospects on the Tyne are concerned, there is ample reason for stating that the year closes better than it commenced. During the last quarter of the year a number of orders have been placed, and several yards that had only vacant berths a year ago, have now vessels on the stocks. The Palmer Co. have two large vessels in frame at their Jarrow yard, and they have at least one other order for a vessel of large size, besides the three torpedo destroyers, referred to in last month's Trade Notes. There is every reason to expect that in the coming year, the state of business at this establishment will be much better than it has been in the twelve months just passed. Messrs. Hawthorn, Leslie & Co. have almost ready for launching a large twin screw passenger steamer of about 6,000 tons gross register and 12,000 I.H.P., which has been ordered by Russian owners, and they have a large cargo boat in course of building for a Newcastle firm. The firm have just secured some additional orders, one of which has been received from a firm at Genoa. The work in progress and in preparation will keep the yard pretty busy during the first half of the year. It should be stated that the large graving dock connected with the yard has, during the pre-[illegible]r, been almost constantly occupied, vessels totalling over [illegible]oss tonnage having been docked for repairs Messrs. C. S. Swan & Hunter have five vessels on the stocks, two of them being in very early stages, and there is also some repair work to be dealt with. The Tyne Shipbuilding Co. have recently launched a remarkably fine vessel, ordered by the Northern Petroleum Steamship Co., Limited, of Newcastle, for employment in the oil trade. They have also two vessels building for a firm at Glasgow, and the outlook at their yard is decidedly good. The Edwards' Shipbuilding Co. have recently laid the keel for a vessel of 5,000 tons carrying capacity, ordered by Newcastle owners, and they have two others on the stocks which are also understood to be for local account. A finely modelled vessel, built for French owners, was launched early in the month by Messrs. Readhead, and it is satisfactory to note that a keel has since been placed in the vacated berth. The firm have received an order from the managing owner of the Prince Line of steamers—Mr. James Knott—for a vessel of similar design and capacity to the *Asturian Prince*, which was launched by the firm in August last. This was the largest of eight steamers which had been launched for Mr. Knott from different yards on the Tyne and Wear between January 1st and September 23rd. The engines and boilers for this and all the other vessels built in their yard have been constructed by Messrs. Readhead. They have also executed a considerable amount of repairs, and their large graving dock has been continuously occupied. Messrs. R. Stephenson & Co., have been doing very little till a late period of the year; but they have now two large vessels in progress, and have some dock gates ordered for the new Barry Docks ready for delivery. It may be mentioned that one of the vessels on the stocks is a Prince liner, and this with the vessel recently ordered from Messrs. Readhead, makes a total of ten additions to Mr. Knott's large fleet this year. Since midsummer work has fallen off greatly at Messrs. Armstrong, Mitchell & Co.'s Low Walker Yard, and nearly all the operatives, as well as a number of the officials, have been discharged or suspended. The frame furnaces have been inoperative since June; but we are pleased to note that the keel for a large vessel has lately been put down, and that the construction of a small one is in progress. Messrs. Wm. Dobson & Co. have also in course of construction a small vessel, which is intended for the oil trade in the Caspian, and they have two large vessels on the stocks, one of which is ready for launching. Messrs. Wood & Skinner launched their last vessel on August 12th, and since then the yard has had a very bare appearance. The stern frame for a vessel ordered by local owners has, however, now been delivered, and it is probable that operations will very soon be resumed in the yard. Messrs. Anderson & Laverick have on the stocks a small passenger steamer for Norwegian owners, and a cargo boat for London owners. They have also in hand a wood fishing vessel. The yard of Messrs. Wigham Richardson & Co., which has been pretty busy throughout the year, shows a slight diminution of work, there being now one or two berths vacant. Messrs. J. P. Rennoldson & Son have a fair amount of work in hand, and the prospect for the early part of 1894 is satisfactory. The Wallsend Pontoons & Dry Dock Co. have dealt with a large amount of repairing work during the present year, and have now one or two good contracts in course of execution. Some repairing firms have had but a small amount of work this year.

Engineering.—Messrs. Hawthorn, Leslie & Co.'s St. Peter's Engine Works have been kept busy throughout the year, a large proportion of the work turned out having been to the order of the Admiralty. The firm have still some Government contracts in hand, besides a considerable quantity of work for merchant vessels. At the Wallsend Slipway Engine Works, the large steamer *Duffield* is, at the time of writing, being supplied with her machinery, and the old steamer *Nentwater* is having her compound engines tripled. At the Neptune Engine Works, business is less active than it was some weeks ago, and a number of hands have been discharged. The North-Eastern Engine Works on the other hand, is slightly busier, and there is a prospect of trade being still further improved in the early months of the year. There is also a better outlook at the Palmer Co.'s Engine Works, and the same remark applies to Messrs. Readhead's Works. Besides engining the vessels built at their yard, Messrs. J. P. Rennoldson & Son have completed extensive alterations to the engines of the s.s. *Racilia*, of Newcastle, having converted them from the ordinary compound to triple-compound, with three new cylinders and three cranks in line.

Messrs. T. Toward & Co., of the St. Lawrence Iron Works, have been well employed during the whole of the year, having

turned out an increased number of their patent "Genetic" boilers, two of which have been fitted on warships. The firm have also executed other important contracts for the Government in connection with the equipment of warships. In the manufacture of other types of boilers there has been considerably increased production, and the output of work in the tank-making department has been unprecedentedly large. The firm have found it necessary during the year to make additions of special machinery to their already extensive plant, and have carried out improvements in other respects, with a view to cope with any increased demands that may be made upon their resources. During the year just closing the Newcastle business of Messrs. Wm. Reid & Co. has undergone considerable expansion, and the depot at Akenside Hill has had its resources pretty severely taxed to keep pace with the demand for the various specialties of the firm, including the well-known automatic reducing valves, the sight-feed lubricators, the self-lubricating sheaves, and pulleys, &c. Towards the close of the year, the home demand for these specialities has developed very rapidly, while the foreign demand has also grown considerably. At Messrs. Clark, Chapman & Co.'s Works, business continues satisfactory, and at Messrs. Carrick & Wardale's establishment there is a fair amount of work in hand. Messrs. Crozier & Mills, the representatives in Newcastle of Messrs. Richards, of Manchester, and a number of other manufacturing firms in the South and Midlands, have been very successful during the year in widening the area of business, and the display of various specialities for which they are agents, at a recent industrial exhibition in Newcastle proved exceedingly attractive to visitors. While referring to this firm, it may be stated that Mr. Mills has received a gold medal in recognition of the special merits of his boat-lowering and picking-up gear, shown at the Chicago Exhibition. Messrs. Noble & Lund, machine tool makers, have commenced operations at their Felling Works, which have been specially adapted to the requirements of their business, and are provided with all modern accessories calculated to facilitate production and ensure good workmanship. The firm will now be able to undertake the manufacture of punching and shearing machines and other kinds of plant required in shipyards and engine works, and there is little doubt that they will be as successful with this heavy class of work as they have been in other branches of machine manufacture. The steel works at Jarrow are just now in pretty active operation, and the Newburn Works are also fairly busy. Messrs. Thomas Grieve & Co., of North Shields and Jarrow, have been kept well employed during the year in the manufacture of ships' ventilators, tanks, lighthouse towers, signal lamps, and general shipping hardware. At the close of the year their workshops are still kept fairly busy on orders from leading shipbuilding and marine engineers on the Tyne and at the other centres. This firm make a speciality of steamers' cooking apparatus and pantry fittings, and have fitted some of the finest vessels afloat, including vessels of the Peninsula and Oriental line, the British India Steam Navigation Co., the North German Lloyds', the Anchor line, Beaver line, Glen line, Hall line, Gulf line, and also vessels built for Messrs. Huddart, Parker & Co., the Russian Volunteer fleet, the Hamburg-American Steam Packet Co., &c. The firm have executed a good deal of work for the British Admiralty, and have within recent years developed an important export trade.

Electric Lighting.—Messrs. J. H. Holmes & Co. have supplied electric light installation for over 40 steamers during the year, the aggregate electrical H.P. being 600, and the total number of lamps 7,500. The vessels lighted by Messrs. Holmes included passenger steamers, oil steamers, cattle steamers, ordinary cargo steamers, and some of the most elaborately equipped steam yachts afloat. The area of the firm's operations during the year has been a wide one, including not only the Tyne, Wear, Tees, and Hartlepools, but also the Mersey, Clyde, and Belfast. Some of the more important installations have been described in different numbers of the MARINE ENGINEER, the latest description being that referring to the *Namonna*, which appeared in the December issue.

THE WEAR.

Shipbuilding.—Some of the Wearside firms who are represented by comparatively small figures in this year's shipbuilding returns, are likely to make a better show next year, for they are beginning well. Messrs. Doxford for instance, have a good deal of work in hand just now, and will by the end of January have launched one of the largest vessels as yet built for the carriage of cargo. Mr. Laing has also a large amount of work in progress, the whole of the building berths in his extensive establishment being occupied. In addition to the vessels put off the stocks at Mr. Laing's yard during the year, the s.s. *Trinidad* has been lengthened 40 ft. in the graving dock, and has also been supplied with machinery of great power. This vessel, which it is understood is to be run in the passenger trade on the other side of the Atlantic, has been most elaborately fitted up interiorly, and has every accessory calculated to reduce the inconveniences of sea travelling to a minimum. Messrs. J. L. Thompson & Sons have recommenced frame turning after a few weeks' slackness in that department, and at Messrs. Blumer & Co.'s yard, frame-turning is also in progress. The yards of the Sunderland Shipbuilding Co. and Messrs. Bartram & Haswell continue slack, but at Messrs. Austins' establishment there are signs of increasing work and it is understood that one of the recently added building berths is about to be utilised. A large amount of repairing work, including the partial reconstruction of several steamers, has as usual been executed at this establishment during the year, and there are at present some contracts of this kind in hand. The alterations, additions and improvements which have been some time in progress, are now approaching completion, when this old established firm will be in a position to build vessels of large tonnage either for Her Majesty's Navy or the Mercantile Marine. Messrs. Priestman and Messrs. Osborne & Graham are fairly well off for work, but other yards at Southwick are slack.

Engineering.—The works of Messrs. George Clark, Limited, are just now very well employed, and it is found necessary to keep a night shift on in some departments. The firm have recently engined the s.s. *Trinidad*, which is designed for a very high rate of speed, and they have other important contracts in progress. The North-Eastern Engineering Co. have fitted the machinery of the large oil steamer *Hotham Newton*, built by Messrs. Raylton Dixon & Co., to the order of Messrs. J. L. Lennard & Sons. They have a fair amount of work now in hand, and will commence the year with moderately good prospects. At the Palmer's Hill works of Mr. Dickinson, two locally built vessels of large size, have been engined during the month. Dull as the times are, there is a satisfactory demand for Dickinson's patent crank shaft, which is sure to be in still greater request when trade improves. In some of the smaller engineering works trade is moderately good, and in iron works, chain works, &c., there is an increase of business.

The Hartlepools.—The yards at this centre continue comparatively brisk, nearly all the building berths of Sir William Gray & Co. being occupied. Messrs. Irvine & Co. are, it is understood, likely to be well employed shortly in repair work. Since September the following vessels engined by Messrs. T. Richardson & Sons have had successful trial trips. On October 14th, the s s. *Cayo Mono*, built by Messrs. Swan & Hunter for Messrs. Bigland & Co., of London, ran a series of progressive trials over the measured mile at Whitby, with very satisfactory results, a mean speed of 12 knots having been obtained. The engines are of the triple-expansion type, having cylinders 24 in., 38 in., and 64 in., by 42 in. stroke, steam being supplied by two large single-ended boilers working at 160 lbs. pressure. During the course of construction the ship and machinery were under the personal superintendence of Mr. H. Barringer, of London. On November 25th, the s.s. *Rothinfels* proceeded from Middlesbro' for a trial of her machinery, preparatory to loading for the East. This vessel has been built for the Hansa line, of Bremen, and it is the second of three orders which the firms of Sir Raylton Dixon & Co. and Messrs. T. Richardson & Sons have received from the same owners. The third vessel, the s.s. *Lindenfels*, is at present being completed at the builders' yard, and will proceed to sea shortly. Engines of the triple-expansion type have been supplied with cylinders 24 in., 38 in., and 64 in. by 42 in. stroke in each case, the boilers being single-ended, with 160 lbs. steam pressure, and built in accordance with German law requirements. The machinery is of the most approved type, and embodies many important accessories, including Geddes' pulsator economisers, and a very efficient design of feed-heater, the invention of Mr. D. Wulff, of Bremen, under whose superintendence the machinery has been constructed. At the trial trip everything worked most satisfactorily, and after an extended run off the Yorkshire coast, the *Lindenfels* returned to Middlesbro', to take in part of her first cargo. On December 12th the s.s. *Green Briar*, the third of the cattle boats which Messrs. Furness, Withey & Co. have built for the Chesapeake and Ohio Steam Ship Co., left Hartlepool for a full speed trial before proceeding direct to Newport News.

These ships are fitted in a most efficient manner for North Atlantic cattle trading, and are adopted for a high rate of speed. The engines are of massive design, the cylinders being supported by cast-iron columns. The diameters of the cylinders are 28 in., 44 in., and 72 in., with a stroke of 48 in. Steam is supplied by two large double-ended boilers working at 160 lbs. pressure, and fitted with Morison's suspension furnaces, made by the Leeds Forge Co., and Geddes' protector fire-doors, which are being largely adopted for steamships. The machinery has been constructed under the personal superintendence of Mr. George McFarlane, the superintending engineer of the company. The weather was most unfavourable for a trial trip, but the working of the machinery was most satisfactory, and those on board were highly pleased with the performance of the ship and engines. Messrs. Richardson are at present engaged in fitting new engines and boilers to the Eastern Telegraph Co.'s cable steamer *Chiltern*, similar work to that carried out on the same company's steamer *Great Northern* last year. At the sheerlegs, the s.s. *Horsa*, built by Sir Wm. Gray & Co., and engined by Messrs. T. Richardson & Sons, for Messrs. Herskind & Co., has lately received her machinery and is being got ready for sea. The engines are 23 in., 38 in., and 62 in., by 42 in., with large single-ended boilers, and have been constructed under the superintendence of Mr. J. R. Fothergill. The year which is just closing has been one of general trade depression, with the result that the output of new work at this establishment has not been so great as usual. On the other hand, the demand for the firm's various specialities has been considerable, the forge department having been kept well supplied with orders for repair work. We have from time to time had occasion to quote instances of the very quick dispatch which Messrs. T. Richardson & Sons are enabled to give their customers for crank and propeller shafts, and can therefore quite understand that this department is kept very busy. We are pleased to hear that several orders for new work have been booked recently, so that the various departments will soon be again in full operation. The Hartlepool Steel and Iron Works are abundantly supplied with orders, and the output was never larger than it is at present. Local shipbuilders get a good proportion of the product, but large quantities are also sent to distant places.

OUTPUT AT THE CENTRAL MARINE ENGINE WORKS, WEST HARTLEPOOL, FOR THE YEAR 1893.

	Name of Vessel.	Port of Registry.	H.P.
1.	*Clam*	London	2,000
2.	*Burma*	Fiume	1,500
3.	*Elax*	London	2,250
4.	*Volute*	London	2,250
5.	*Oscar II.*	Bergen	1,300
6.	*Webster*	West Hartlepool	1,500
7.	*Adjutant*	London	1,250
8.	*Nador*	Algiers	1,000
9.	*Roumania*	West Hartlepool	1,300
10.	*Penarth*	Cardiff	1,500
11.	*Chickahominy*	West Hartlepool	2,400
12.	*Bullmouth*	London	2,250
13.	*Maori*	Southampton	2,750
14.	*Ariadne Alexandra*	London	1,000
15.	*Baracaldo*	Bilbao	700
16.	*David Mainland*	West Hartlepool	900
17.	*Aeolus*	West Hartlepool	1,300
18.	*Castanos*	Cardiff	1,500
19.	*Twilight*	West Hartlepool	1,000
20.	*Pacific*	Hull	1,500
21.	*Unionist*	Newcastle	1,300
22.	*Indralema*	Liverpool	1,600
		Total for Machinery in New Ships	34,050
	CONVERSIONS.		
23.	*Mark Lane*	Cardiff	1,000
24.	*Sweden*	West Hartlepool	500
25.	*Albania*	West Hartlepool	1,000
		Total for New and Old Ships	36,550

Besides the work named, which relates to both engines and boilers, there have been built during the year 12 large boilers of the ordinary marine type for a sugar refinery in China. will be seen by the list that the number of old steamers' machinery converted on the high-pressure compound system is increasing, the present year having brought three such conversions to the Central Engine Works. It appears probable that in the near future the actual lists of H.P. turned out will contain an increasing proportion of this class of work, as the results are so far proving eminently satisfactory, compared with what the boats were doing previously with their low-pressure compound engines.

The total output of H.P. at these works is the largest but one in any year since the works commenced some nine years ago. The number of vessels engined has decreased during recent years, but there is a constant increase in the average H.P. per new vessel; for the present year the average is about 1,550 I.H.P. as compared with a little below 1,500 H.P. last year.

It is interesting also to know that the Central Engine Works commence the New Year with a considerable amount of work in hand, although a long time has passed since the last of the orders now in execution was placed.

Stockton.—Messrs. Craig, Taylor & Co. have put down the keels for two vessels, and they expect to have the yard in full operation very early in the year. The following vessels fitted with engines by Messrs. Blair & Co. have taken trial trips during November:—The s.s. *Kilburn*, built by Messrs. Ropner & Sons, of Stockton, for Messrs. Watts, Ward & Co., of London, having engines with cylinders 23½ in., 39 in. and 64 in. by 42 in. stroke. The s.s. *Georgian Prince*, built by Messrs. Armstrong, Mitchell & Co., of Low Walker, for Mr. James Knott, of Newcastle, having engines with cylinders 24 in., 40 in., 65 in., by 42 in. stroke. The engines for both vessels are constructed to work at 160 lbs. steam pressure, and at the trial trips gave full satisfaction.

Middlesbro'.—Messrs. Raylton Dixon & Co.'s yard was well employed during the early part of the year, but in the latter part orders fell off, and for some weeks past the establishment has been very slack. In addition to the vessels built by the firm this year, they did a large amount of repair work. Messrs. W. Harkness & Sons have also repaired a number of local and foreign vessels, in addition to the new work turned out. Messrs. Copley, Turner & Co., of the Vulcan Works, are experiencing a good demand for steam winches and other specialities. The Harris' Patent Compound Filter, for the filtration of boiler feed water, attracted great attention at the General Engineering and Industrial Exhibition, recently held in Newcastle. As the speciality was described and illustrated in the November number of the MARINE ENGINEER, there is no necessity to enumerate the advantages claimed for the filter, but it is proved by the great demand for the article that has arisen, that the advantages are being appreciated by shipowners.

THE MERSEY.

(*From our own Correspondent.*)

THE past year has been a most unsatisfactory one as regards all branches of industry connected with the marine and general engineering, shipbuilding, and the iron and coal trades generally throughout this district, and it will be memorable for the serious disputes between labour and capital, culminating in the disastrous and protracted struggle in the coal trade, which, for a considerable portion of the year, more or less disorganized the principal industries throughout Lancashire. For the first three or four months two-thirds of the staple industry of the district was paralyzed by a dispute with regard to wages, and the year opened with a dispute with the ironstone miners and blast-furnacemen in Lincolnshire, which, for a time, caused the damping down of a considerable number of furnaces which largely supplied this district with pig-iron. In addition, the iron and coal trades were, for several months during the earlier part of the year, more or less unsettled, owing to the increased charges for carriage imposed by the Railway Companies under the revised rates. During February the miners commenced an agitation for a general stoppage of work, extending over a week or a fortnight, which, for the time being, caused quite a scare in the market. Then came a movement on the part of the coal-owners for a reduction in wages, which, in July, was followed by a stoppage of the pits, extending over nearly four months, and, with the close of the year, the iron, engineering, and coal trades are only slowly recovering from the effects of this protracted dispute.

Throughout the marine engineering and shipbuilding industries there has been a smaller weight of work given out than for a considerable number of years past, and with the exception of Messrs. Laird Bros., of Birkenhead, the engineering and shipbuilding firms on the Mersey have had comparatively very little to do. Marine engineers have had to depend almost entirely upon repair work to keep them going, very few new orders of any weight having been given out. With regard to the shipbuilding trade, the operations on the Mersey have been on a very limited scale, and the tonnage turned out has been smaller than for many years past. The total for the year has been only 8,671, as compared with 39,330 in 1892, 23,736 in 1891, 30,577 in 1890, 35,773 in 1889, 22,538 in 1888, and 10,664 in 1887.

The following is the list of work completed by Messrs. Laird Bros. during the year:—

H.M. first-class battleship *Royal Oak*, of 14,000 displacement, and 11,000 I.H.P., though launched towards the close of 1892, has been completed during the past year, involving a very large amount of work. Two twin-screw torpedo gunboats—the *Onyx* and *Renard*—of 810 tons displacement, and 3,500 I.H.P., launched in 1892, have been completed during the past year, for Her Majesty's Government, and have passed satisfactorily through their trials at Sheerness. In addition to new vessels and machinery which have been completed, the firm have also carried out a large amount of repair work, including a general overhaul and fitting of new saloons in the steamships *New York* and *Paris*, and general overhaul and fitting a new system of induced draught in the steamship *Berlin*. Messrs. Laird Brothers, it may be added, have at present in hand several vessels of war, of torpedo, cruiser and other types, for the British and foreign Governments, and a set of triple-expansion paddle engines, with boilers, of 4,500 H.P., for the L. & N.W. Railway Co.'s express steamer *Banshee*. Messrs. Cochran & Co., of Birkenhead, have turned out during the year fifteen small steamers and barges, their total tonnage being 223, and total H.P. 357. With regard to shipbuilding on the Liverpool side of the Mersey, it may be mentioned that the firm of Messrs. Thomas Royden & Sons, having dissolved partnership early in the year, owing to the retirement of Mr. Thomas B. Royden and Mr. Joseph Royden, from the shipbuilding trade, the junior partner, Mr. Thomas Royden, together with his brother, Mr. Joseph B. Royden, continued the business of the above firm at the same address, Queen's Pier Head Works, West Side of Queen's Dock, Liverpool, and under the style of Thomas Royden & Co., have turned out a steel sailing ship, the *Prince Robert*, of 2,846 tons, besides completing the repairs of several large steamers and sailing vessels during the year. The firm have a very large and extensive plant, and are making the repairs department a speciality, as they are able to execute any repairs whatever on a large scale, either to steamers or sailing vessels, at a very reasonable cost, as the Graving Dock is alongside of their works. Messrs. W. H. Potter & Sons, Liverpool, have during the past year constructed a steel twin-screw steamer, the *Republica*, of 300 tons, and 200 H.P., a steel screw-steamer, *Adelia*, 28 tons and 20 H.P., and two steel barges, each of 110 tons. Messrs. Gilchrist & Co. have built twelve steel barges, each of 56 tons, which are intended for traffic on the Manchester Ship Canal, and Messrs. R. & J. Evans & Co. have a large steel barque at present on the stocks. Most firms on the Mersey have been kept fairly well engaged on repair work.

The general engineering industries have for the most part been only very moderately engaged. Heavy engine builders have, perhaps, been the best off for work, and some of the leading firms have been pretty fully employed all through the year; but, as a rule, establishments have scarcely been kept going more than from hand to mouth. The leading machine-tool makers have managed to secure a fair amount of work to keep them going, and boiler-makers have also been tolerably busy until nearly the close of the year, when new work began to fall off considerably. The locomotive building trade has, perhaps, never been in a more depressed condition than during the past twelve months, and work has only been obtainable to keep makers even partially going at excessively low figures. The returns issued by the Trades Union organizations have shown a steady increase in the number of unemployed members on the books, and the period of the coal stoppage had most disastrous effects in throwing large numbers of men out of work. In this immediate district, the Amalgamated Society of Engineers, during a considerable portion of the coal stoppage, had more than double their ordinary number of members on the books in receipt of out-of-work benefit; even since the dispute has been settled, the position has not very materially improved, and with the close of the year there were something like 12 per cent. of the local membership in receipt of donation benefit. The Steam Engine Makers' Society has not suffered to the same extent, but still their returns have also shown a substantial increase in the number of unemployed.

With regard to the iron trade, the year opened with, if anything, rather a hopeful tone, especially in raw material, prices tending to harden, and makers cautious about entering into forward engagements, whilst merchants very chary about underselling. Quotations for Lancashire pig-iron averaged 44s. for forge to 45s. 6d. for foundry, delivered equal to Manchester. District brands were practically out of the market, owing to nearly all the furnaces being damped down, but quoted prices for Lincolnshire were about 43s. for forge to 44s. and 44s. 6d. for foundry, with Derbyshire makers having very little to offer, and firm at 45s. for forge to 48s. and 48s. 6d. for foundry, less 2½ delivered Manchester. Outside brands offering in the district were also firm at 45s. 4d. to 45s. 10d. for Middlesbrough, net cash, delivered Manchester, with Scotch iron quoted at 47s. 3d. to 47s. 6d. for Eglinton, and 48s. 6d. for Glengarnock, net prompt cash at the Lancashire ports. As, however, the year advanced, a generally depressed tone prevailed, with a downward tendency in prices. With the close of the first quarter the outlook was extremely unsatisfactory, and until very nearly the end of the second quarter business continued to drag on from hand to mouth, with a persistent downward tendency in prices. During June, however, rather more buying came upon the market, the low prices no doubt tempting buyers to place out orders. Lancashire pig-iron had not given way to the same extent as some of the district brands, quotations being about 43s. for forge to 44s. for foundry, but Lincolnshire could be bought at 39s. for forge to 40s. and 40s. 6d. for foundry, Derbyshire at 39s. 6d. for forge to 43s. and 45s. 6d. for foundry, less 2½ delivered Manchester, with Middlesbrough iron about 42s. 10d. to 43s. 4d., net cash, delivered Manchester, and Eglinton about 44s., net cash, at the Lancashire ports. This increased buying brought forward a firmer tone, and prices gradually advanced, but the improvement was not long maintained, and at the commencement of the second half of the year business again gradually settled down into a quiet condition, although makers, being mostly fairly well sold, remained firm at slightly advanced prices, but merchants began to undersell. The district makers, with the commencement of July, discontinued their previous allowance of 2½ per cent. discount, placing their list rates on the net cash basis, and Lincolnshire prices were fixed at 39s. 3d. to 39s. 6d. for forge, and 40s. 6d. to 41s. for foundry, net cash, delivered Manchester. With the close of July the stoppage of the collieries only added to the unsatisfactory position generally; there was not only a considerably lessened production of pig-iron, but an equally restricted demand for consumption. Lancashire makers advanced their list rates 2s. per ton, and were quoting 44s. 6d. for forge to 45s. 6d. for foundry, less 2½, whilst in Lincolnshire prices hardened up to 40s. for forge, and 41s. 6d. for foundry, with Derbyshire foundry quoted at 47s. 6d. net cash, delivered Manchester, but outside brands remained without any really quotable change. For the next three or four months, during the stoppage of the collieries, business continued to drag on in merely hand-to-mouth fashion. With the restarting of the pits, and the forges getting into operation, a more active demand came forward for pig-iron, which gradually hardened up prices. Lancashire makers were able to get 45s. for forge, to 45s. 6d. for foundry, less 2½ per cent.; Lincolnshire, 41s. 6d. to 42s. for forge, and 43s. 6d. to 44s. for foundry, with Derbyshire foundry nominally quoted from about 50s. to 52s. net cash, delivered Manchester, whilst for Middlesbrough iron prices got up to 44s. 4d. net cash, with Eglinton quoted at 47s. 6d, and 48s., Glengarnock at 48s. 6d. to 49s. net, prompt cash, delivered at the Lancashire ports, but the higher prices for Scotch were due, not to any great demand, but to the furnaces in Scotland being damped down, owing to a strike of the miners there for an advance in wages.

In the finished iron trade, the year opened with business in a depressed condition and prices weak, bars being quoted at £5 12s. 6d., sheets at £7 5s. to £7 7s. 6d., and hoops, at £6 2s. 6d. to £6 7s. 6d., delivered Manchester. Many of the forges were scarcely running more than half time, and during March the hoop-makers were compelled to reduce their list rates 2s. 6d.

per ton, which was shortly afterwards followed by a giving way in other descriptions of finished iron, Lancashire bars being quoted at £5 10s., and Staffordshire, £5 10s. to £5 12s. 6d. The lower prices, however, scarcely brought forward any increased weight of business, and the downward tendency continued, until towards the close of the first half of the year, when Lancashire makers were taking £5 7s. 6d. for bars, and hoop-makers had to further reduce their list rates 2s. 6d., bringing their prices to £5 17s. 6d. for random, and £6 2s. 6d. for special cut lengths, delivered. These low prices eventually brought forward rather more buying and with the stoppage in the coal trade, gradually causing cessation of operations at finished iron works, makers became pressed with orders. One or two of the forges were kept going for awhile with higher priced coal, and to cover this increased cost, list rates were put up 2s. 6d. per ton, but eventually the entire manufacture of pig-iron throughout Lancashire had to be suspended until the settlement of the coal strike, and when operations were resumed it was found difficult to maintain any very material advance upon prices. Makers were able to get about £5 15s. upon bars for prompt delivery, but for forward sales they were in most cases ready sellers at £5 12s. 6d., whilst as regards hoops, they were unable to put up their prices at all, and quotations remained, for these, £5 17s. 6d. for random, and £6 2s. 6d. for special cut lengths, delivered Manchester, with sheets quoted at about £7 5s. to £7 7s. 6d. per ton, delivered in the Manchester district.

The steel trade has remained extremely quiet all through the year, with a persistent downward tendency in prices. Hematites which in January were quoted at what was then considered the very low price of 55s. to 55s. 6d., less 2½, delivered Manchester, have gradually eased down, until with the close of the year it was difficult to get more than 53s. 6d., whilst steel boiler plates, which at the commencement of the year showed a temporary upward tendency, and were quoted at £6 12s. 6d., have gradually weakened until they were readily obtainable at £6 7s. 6d., and even with the close of the year, when the production in Scotland was completely stopped, owing to the dispute in the coal trade, current prices in the market did not exceed more than about £6 10s. per ton, delivered to consumers.

In the coal trade the year opened with a generally steady tone throughout the market, so far as the better qualities of fuel were concerned, best Wigan Arley being firm at 12s. 6d. to 13s., Pemberton 4-ft. at 10s. 6d., and common house-fire coals at about 8s. 6d. to 9s. per ton at the pit-mouth. The exceptional mildness of the season necessarily caused but a limited demand, and trade remained in a generally depressed condition right on through the summer, with very low prices ruling, until the stoppage of the pits at the end of July, of course produced an exceptional demand, and a rapid upward movement. With regard to all descriptions of fuel for iron making, steam, and general manufacturing purposes, the position of trade in this district all through the year could scarcely have been more unsatisfactory. The absence of activity in the iron-making and other large coal-using industries resulted in the common qualities of round coal becoming a complete drug in the market, and being offered at almost any figure that could be obtained, whilst the effect was still further felt in the excessively low prices which were quoted to secure contracts for shipment and steamers' use, for locomotive fuel, and gas-making purposes. Steam coal, which at the commencement of the year was quoted at about 7s. 6d., was gradually forced down in price until it could be readily bought at about 6s. to 6s. 6d. per ton at the pit-mouth, and the contracts for locomotive fuel were placed at 6s. 3d. to 6s. 6d. per ton, prices very considerably under even the extremely low figures taken for the previous year's contracts. With regard to gas coal contracts, they were taken at quite 1s. to 1s. 6d. per ton under the prices obtained during the previous year, and steamship contracts were also placed on a similar basis. So far as engine classes of fuel were concerned, the depression in the round coal trade necessarily had the effect of creating rather a scarcity of slack, which gradually had a hardening tendency on prices. During the early part of the year considerable quantities of engine fuel were necessarily thrown upon the market, owing to the protracted stoppage in the cotton trade, but when the mills resumed work consumers began to experience difficulty in obtaining fuel supplies, and prices were gradually advanced as the pressure for engine fuel continued. Common slack could be bought early in the year at 3s. to 3s. 6d. per ton, the better qualities at 4s. 9d. to 5s., and burgy at 6s. 3d. to 6s. 6d. per ton at the pit-mouth, but these classes of fuel gradually advanced until the lower descriptions of slack were not obtainable under 4s. 6d. to 5s., best slack about 6s., and burgy readily fetching 7s. per ton at the pit-mouth. With the coal stoppage, prices for all descriptions of fuel of course at once began to move rapidly upwards, until towards the beginning of November house coals were not obtainable under about 24s. to 26s. per ton, common round coals, 22s. to 23s., and engine classes of fuel about 19s. to 20s. per ton at the pit-mouth. These prices were, of course, only temporary, and with the settlement of the dispute, which was followed by an immediate resumption of work at the collieries, prices almost immediately got back to very nearly old rates, and with the close of the year quotations were about 14s. to 15s. for best Wigan Arley, 13s. to 13s. 6d. for Pemberton 4-ft., and seconds Arley 11s. 6d. to 12s. 6d.; for common house coal, 10s. 6d. to 11s.; for steam and forge coal, 8s. to 8s. 6d.; for burgy, 6s. 6d. to 7s. 3d. for best slack, and about 5s. 3d. to 5s. 9d. for inferior descriptions, at the pit-mouth.

NORTH-WEST OF ENGLAND.

(*From our own Correspondent.*)

Barrow-in-Furness.—A considerable improvement has taken place in the prospects of the shipbuilding and engineering trades of this district during the past month, and it seems evident from the present position of orders and the prospects of new orders which are held out that the year 1894 will be one of the most brisk and active in the existence of this trade ever experienced in this district. During the month the Naval Construction and Armaments Co. has been entrusted with an order from the Clan Line, of Glasgow, to build three steamers, chiefly for cargo-carrying, to be employed in the South African trade. The steamers are of 4,000 tons burden. They will be fitted with triple-expansion engines. The Barrow Co. has also received an order from the British and African Steam Navigation Co. for the building of two steamers of the *Acra*, *Bathurst* and *Batanga* type. This will make 12 or 13 built by the Barrow Co. for these owners, who are doing a very successful business in the development of the African trade. The Admiralty have entrusted the Naval Construction and Armaments Co. with the construction of three torpedo destroyers, capable of steaming at the rate of 27 knots. These will be fitted with boilers, the patent of Mr. Blechynden, the manager of the engine department at Barrow. The peculiarity of these boilers is that the water is in the tubes. They have also received an order for the construction of the engines, etc., for H.M.S. *Majestic*, which is being built at Pembroke, and in addition to these have in hand several repair jobs, including the tripling of the Clan Liner *Clan Graham*, new boilers for the Morecambe steamer *Express*, new boilers for the s.s. *County of York*, new boilers and triplicating of engines for a large Cork steamer, and new boilers for the tug *Duddon*. They are now making considerable progress in the work of building the 6,000 tons steamer for Mr. Royden, of Liverpool, and a Channel steamer for the British and Irish Steamship Co. The Barrow Co. is one of the firms which has been asked to tender for the construction of H.M.S. *Powerful*, and it is probable that the success which has attended the large dredger *Brancker* will lead to an order for a similar vessel finding its way to Barrow from another port. With these prospects before the Barrow Co., they will have a good total as regards tonnage and also engine power at the close of 1894. The works have been on short time, and only a comparatively small number of men have been employed, but the pattern-makers, moulders, smiths, and joiners are now working full time, and in the beginning of 1894 the whole of the works will be at full swing.

New Shipbuilding and Engineering Works at South Shields.—The Tyneside Shipbuilding, Engineering and Repairing Co., having completed the construction of their works in Wapping Street, South Shields, are now in a position to undertake the building of tugs and other small crafts, and also the repairing of all classes of vessels. The works are most conveniently situated, and being fitted up with modern plant and machinery of the best description, are well adapted for the economical execution of contracts. There is an extensive quay frontage and a powerful crane for lifting heavy weights, so that the removal and refitting of propellers and other work of a similar kind can be effected with great despatch. The manager is Mr. Robert D. Lawson, who for a great number of years was connected with a well-known shipbuilding and engineering firm on the Tyne.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Petöfi.—On Thursday, November 23rd, Messrs. Wigham Richardson & Co. launched from their Neptune Shipyard, Newcastle-on-Tyne, a finely-modelled steel screw steamer, which they are building to the order of the Royal Hungarian Sea Navigation Co., Adria, Limited, of Fiume and Budapest. The vessel is 285 ft. in length and 38 ft. beam. She is to be rigged as a two-masted schooner, and will be supplied with the most modern and improved machinery to facilitate the working of the ship and the rapid loading and discharging of her cargo. The engines, which with the boilers are also being constructed by Messrs. Wigham Richardson & Co., are of the triple-expansion type, and are intended to drive the vessel at a good speed. The vessel, with her outfit, engines, and boilers, is being constructed under the superintendence of Mr. Alexander Rolland, who was present at the launch. As the vessel left the ways she was named the *Petöfi*, the ceremony being performed by Mrs. Goodman, of Walker Gate.

Lightship.—On Friday, November 24th, was launched the second of the two lightships, built by Messrs. Wm. Allsup & Sons, Preston, to the order of the Commissioners of Irish Lights. The vessels are intended for service on the Irish coast, and for this purpose they have been specially designed to withstand the severest weather, and to keep the sea for a great number of years without damage to or deterioration of their structure, and consequently with little outlay for repairs, &c. The methods of construction adopted in former years have long been considered very unsatisfactory. The old wooden vessels certainly served their turn; but it was found in course of time that the periodical repairs effected on them led to an enormous expenditure, and, moreover, that the building of new vessels of this class became more and more difficult owing to the growing scarcity of suitable and well-seasoned timber. Vessels built entirely of iron were then tried; but such, it was discovered, could not remain on a station for two years without excessive fouling of bottom, and subsequent decay of the hull; and no anti-fouling composition has hitherto been invented of a really efficient character that would overcome this defect. The iron vessels were therefore rejected in favour of those built on the composite principle; a system which has been partially successful, but which, however, has neither the strength of the iron class nor, owing to the galvanic action which occurs from contact of copper and yellow metal with the steel or iron immersed in the sea water, the endurance of the wooden class. The principle on which the new Irish vessels are built, and by which it is confidently hoped to secure the strongest possible structure with the maximum of endurance at sea, is a compromise between the two types just alluded to, and it is practically the same principle which the Admiralty adopts in vessels for foreign service which are required to remain at sea for a long period free from the necessity of docking. There is, in the first place, a complete steel hull rivetted and caulked as in the case of an ordinary steel or iron vessel; on this is worked from keel to gunwale sheathing of teak, well set in a mixture of red and white lead. The fastenings of the teak sheathing are nut and screw bolts made of a suitable composition of brass for withstanding galvanic action. The bolts are all screwed through the steel plating—which has previously been tapped with a screw tap for the purpose—and when sufficiently tight a nut is placed on the inside. By the means here indicated the bolts are made perfectly water-tight, and therefore no galvanic action can take place between them and the steel plating of the hull. The teak sheathing is afterwards covered with felt and Muntz's metal, to prevent fouling of bottom when at sea, and the bottom of vessel inside is covered with Portland cement. The main deck is partially plated with steel and then covered with teak and Dantzic fir. A special feature of these vessels are the hawsepipes for the cables. They are formed of double tubes, the inner of cast iron and the outer of steel strongly rivetted to the main deck and the vessel's side, the space between the tubes being filled with cement. A neat house is fitted on deck, partly for sheltering the men and partly for giving ventilation for the machinery space. The machinery consists of a hot-air engine for working the fog siren, and is placed in a well built of steel plates and sunk in the lower deck. The lantern is carried on a steel mast, 2 ft. in diameter, the latter having a passage way for the men through its centre from top to bottom, and is stayed with crucible steel wire ropes; the lantern is hoisted by a powerful winch. Other fittings are Harfield's patent windlasses and cable stoppers, and Lenox patent anchors. They are also made suitable for carrying heavy mineral oil, for which purpose a storeroom, made water and fire-proof by means of a sheet lead lining, is built in the stern. A magazine for storing powder and signals is also provided and lined with lead. The accommodation for the master and men is very neatly and comfortably arranged, and all the deck woodwork is of teak, strongly made in the best manner. All the fittings, ceiling, &c., in the 'tween decks and in the hold are made portable, in order to give facilities for cleaning and painting the vessel's skin. These vessels have been built to the designs, and under the direction of Captain A. K. Galwey, the inspector of Irish Lights, and Mr. George Idle, naval architect.

Republica.—On November 27th Messrs. W. H. Potter & Sons launched from their shipbuilding yard, Queen's Dock, a steel twin-screw steamer of the following dimensions:—Length, 140 ft.; breadth, 27 ft.; depth of hold, 9 ft.; extreme depth, 23 ft. 6 in. The vessel has been specially constructed for passenger and cargo service on the River Amazon. She has two decks above the main deck, one of which is arranged for the exclusive use of passengers. The vessel is fitted with a steam winch, direct steam windlass, and Taylor's patent stockless anchors. On leaving the ways the vessel was named the *Republica*, by Mrs. Thomas Greaves. The steamer has been built to the order of Mr. Robert Gillies, of Liverpool. The engines and boiler have been constructed by Messrs. Dunlop, Bell & Co.

Terrier.—On December 6th Messrs. John Blumer & Co. launched at Sunderland, a steel screw steamer, built to the order of Mr. Wilhelm Wilhelmsen, of the following description:—Length over all, 264 ft.; beam, 35 ft. 6 in.; depth, 18 ft. 2 in. The engines and boilers are by Messrs. G. Clark & Co., Limited, Southwick.

Woodleigh.—On December 6th there was launched by Messrs. Joseph L. Thompson & Sons, at Sunderland, a steel screw steamer, built to the order of Messrs. John H. Barry & Co., of Whitby, of the following dimensions:—Length, 311 ft.; breadth, 41 ft. 3 in.; depth, 21 ft. 10 in. The engines are by Mr. John Dickinson, and have cylinders 22 in., 36 in., and 59 in. diameter respectively, with a stroke of 39 in.

Twilight.—On Thursday, December 7th, Messrs. Furness, Withy & Co., Limited, launched from their yard at Hartlepool a steel screw steamer, built to the order of Messrs. John Wood & Co., West Hartlepool. She is a fine type of a modern cargo boat measuring over 270 ft. in length, and built throughout of Siemens-Martin steel, with a large measurement and deadweight capacity, and built to the highest class at Lloyd's. The vessel has a long raised quarter-deck, long bridge-house, and a topgallant forecastle. The holds are fitted with iron-grain divisions, and all decks, deck erections, skylights, bulwarks, bulkheads, &c., are constructed of steel and iron. Cellular bottom, fitted all fore and aft for water ballast. The greater portion of the plates are in 24 ft. lengths, making the structure of the ship very strong. Four steam winches, two donkey boilers, patent steam steering gear amidships, screw gear aft, direct steam patent windlass by Emerson, Walker & Co., stockless anchors hauling into hawse pipes, and other modern appliances are fitted for the handy working of the vessel. The saloon and cabin providing accommodation for the captain, &c., is handsomely finished in polished hardwood, with painted panels, executed in an effective style by the staff of ladies employed by the firm. She will be rigged as a two-masted fore and aft schooner, the masts being fitted with loose topmasts to enable the vessel to go under bridges and to navigate the Manchester Canal. The steamer has been constructed under the personal supervision of Mr. R. Craig, the owner's superintendent. She will be fitted with triple-expansion engines by the Central Marine Engine Works, West Hartlepool. On leaving the ways she was gracefully christened *Twilight* by Miss Wood

Pacific.—On Saturday, December 9th, Messrs. William Gray & Co., Limited, launched a fine steel screw steamer, which they have built to the order of Messrs. W. H. Cockerline & Co., of Hull. The vessel will take Lloyd's highest class. Her dimensions are:—Length over all, 310 ft.; breadth, 42 ft.; and depth, 20 ft. 10 in. The deck erections consist of a poop, raised quarter-deck, and partial awning deck. The saloon and cabins are aft, the engineers' rooms in the after part of the awning

deck, and the crew's accommodation forward. The hull is built on the web frame system, with cellular double bottom throughout. Large hatchways are fitted, four steam winches, steam steering-gear amidships, screw gear aft, large patent donkey boiler, patent direct steam windlass, by Emerson Walker & Co., and shifting boards throughout, boats on beams overhead, two masts with schooner rig, and all modern working appliances will be fitted for general trading. The Central Marine Engine Works of Messrs. W. Gray & Co., Limited, supply fine triple-expansion engines, having cylinders 24 in., 38 in., and 64 in. diameter, with a 42 in. piston stroke, and two large steel boilers to work at 160 lbs. pressure per square inch. The vessel and machinery have been built under the superintendence of Messrs. J. Jamieson & Co., of Hull, on behalf of the owners, and the ceremony of christening the steamer *Pacific* was gracefully performed by Miss Cockerline, daughter of the managing owner.

Duffield.—On Saturday, December 9th, there was launched from the yard of the Tyne Iron Shipbuilding Co., Limited, Willington Quay-on-Tyne, a large tank oil steamer, which has been built to the order of Messrs. The Northern Petroleum Tank Steamship Co., Limited (Messrs. Hunting & Son, of Newcastle-on-Tyne, managers). The vessel is of the following dimensions, viz.:—Length, 351 ft.; breadth, 44 ft.; depth, 30 ft. 2 in., and is to class 100 A1 at Lloyd's, on the spar deck principle, for carrying petroleum in bulk. She is divided into sixteen separate oil-tight compartments, has an oil-tight bulkhead running longitudinally along the centre line of the vessel, and is especially strengthened throughout. The machinery, which is to be supplied by Messrs. The Wallsend Slipway and Engineering Co., Limited, will have cylinders 25½ in., 41 in., and 68 in. diameter, by 48 in. stroke, with three large single-ended boilers. The vessel is also fitted with steam windlass, steam winches, steam capstans, and patent steam steering apparatus fitted at the after part of the vessel and worked by means of controlling rods from the bridge amidships. Her outfit includes the very latest developments and appliances for the trade that she is intended to be engaged in, including double set of oil pumps and piping, and a complete system of electric lighting. During construction the vessel has been superintended by Captain Brunton, and the machinery by Mr. Shaw. On leaving the ways the vessel was named the *Duffield*, by Mrs. Hugh Barbour, daughter of Alderman James Duffield, of Workington, who is chairman of the company.

Roxby.—On December 9th Messrs. Ropner & Son, of Stockton, launched a cargo steamer of the following dimensions, viz.:—Length over all, 324 ft.; breadth, 40 ft. 6 in.; and depth, 23 ft. 7 in. Her engines are by Messrs. Blair & Co., Limited, and have cylinders of about 1,200 I.H.P., with two large steel boilers, working at 160 lb.

Ville d'Arras.—On December 9th there was launched by Messrs. John Readhead & Sons, West Dock, South Shields, a steel screw steamer, dimensions as follows:—Length, 260 ft.; breadth, 34 ft. 3 in.; and depth, 24 ft. 2½ in. Her engines, by Messrs. J. Readhead & Sons, are of triple-expansion type, having cylinders 21½ in., 35 in., and 59 in. in diameter, with a piston stroke of 39 in. Steam will be supplied by two steel boilers, working at a pressure of 160 lb. to the square inch. The vessel, which has been built to the order of the Compagnie Générale des Bateaux du Nord, of Dunkirk, is intended for the wine and general cargo trade. She is of the spar-deck type, and is fitted with water ballast in holds.

Pride of the Humber.—On December 11th, there was launched by Messrs. Cook, Welton & Gemmell, at Hull, a steam trawler, built for the Sheriff of Hull (Councillor R. Simpson).

LAUNCHES—Scotch.

Jargoon.—On November 25th there was launched from the ship-building yard of Messrs. Scott & Sons, Bowling, a screw steamer of 630 tons deadweight, built to the order of Mr. Wm. Robertson, 15, Gordon Street, Glasgow, for his general coasting trade. The engines, which are compound surface-condensing, are being supplied by Messrs. Ross & Duncan, Govan. On moving down the ways the steamer was named *Jargoon* by Miss M'Ewan, Strathblane.

Neur-el-Bahr.—On November 25th there was launched by Messrs. Gourlay Brothers & Co., at Dundee, a steel screw steamer, built to the order of Messrs. Thompson & Campbell, London, for Turkish owners. The vessel was named the *Neur-el-Bahr*. The *Neur-el-Bahr* was launched with steam up, and has been built to class 110 A1 at Lloyd's. She is 150 ft. long by 23 ft. broad, and is 11 ft. 3 in. deep. The engines are triple-expansion, and of 450 H.P.

King George.—On November 28th Messrs. Russell & Co. launched from their Greenock yard a sailing ship, named the *King George*, for Messrs. J. A. Walker & Co., Glasgow, to be engaged in the general carrying trade. Dimensions:—Length, 278 ft.; breadth, 42 ft.; depth, 24 ft. 3 in.; of 2,150 tons register, and a deadweight carrying capacity of 3,550 tons. The construction of the *King George* was superintended by Mr. Stewart, Glasgow, and she will be commanded by Captain Drummond, formerly of the *King James*. In the vacant berth the keel of a large steamer will be laid, which will make a steam tonnage of 24,000 under construction in this yard.

Marechal Suchet.—On November 28th there was launched from the ship-building yard of Messrs. A. M'Millan & Son, Limited, a handsome steel sailing ship of about 1,950 tons register, which has been built to the order of Messrs. A. Ruffer & Sons, London. The vessel, on leaving the ways, was named the *Marechal Suchet*, the christening ceremony being performed by Mrs. C. H. Garnett, of West Norwood, London.

Briton.—On November 30th, in presence of a large company of Glasgow and local gentlemen, Messrs. J. & J. Hay, shipowners, Glasgow, launched from their yard at Kirkintilloch, a screw steamer of 110 tons. The tidy craft was named the *Briton* by Miss Mary C. Cameron, Southbank House, Kirkintilloch. At the cake and wine service which followed, Mr. John Hay, who presided, mentioned that this was the twenty-second vessel which had been built in the yard under the superintendence of Mr. John Thom, the yard manager.

Glenogil.—On December 7th Mr. Jarvis launched from his yard at Anstruther a steam liner to the order of the East of Fife Steam Fishing Co. The vessel was named the *Glenogil* by Miss Oliphant, as she left the ways. The dimensions are:—Length over all, 96 ft.; length of keel, 88 ft.; breadth, 18 ft. moulded; and depth, 10 ft. Her engines are 30 H.P., and she is fitted up with fish-lockers and ice-room. The cabin contains accommodation for nine men. This is the second steam fishing company with a registered office at Anstruther.

Vala.—On December 9th Messrs. Ramage & Ferguson, Limited, launched the first of two steamers they are building for Messrs. J. T. Salvesen & Co., Grangemouth. They carry over 1,300 tons deadweight, and are expected to steam 9 knots loaded. The steamer was named *Vala* by Miss Salvesen, Blairbank, Polmont, the daughter of the managing owner.

Rona.—On December 12th Messrs. David & William Henderson & Co. launched from their yard at Partick the large steam yacht *Rona*, which they have built to the design of Mr. G. L. Watson, for Mr. A. H. E. Wood, of Rugby. The vessel is of handsome model and exceptional dimensions. The length over all is about 270 ft.; beam, 30 ft. 3 in.; depth, 19 ft. 8 in. The Thames measurement tonnage will be about 1,000. She has been built under Lloyd's special survey, and is classed in their yacht register 100 A1. The arrangements for the accommodation of the owner and his friends are of the most complete description, everything that can add in the least degree to their comfort having been included in the yacht's design. There is a great height in 'tween decks—nearly 9 ft. —which is of advantage in the state-rooms and saloons. The state-rooms are eleven in number, and are of large size. They have a polished walnut dado with figured cretonne above. The five larger state-rooms have baths under the floors, supplied with hot and cold water. A complete system of electric bells is fitted throughout the rooms. Immediately forward of the machinery space is the pantry, which is complete with all the usual dressers, racks, &c. It communicates with the galley above by means of a hoist, and with the saloon by a serving window. The dining saloon is a handsome apartment well lighted by a large dome skylight filled with stained glass. Aft of the engine space is the boudoir, which is fitted with a handsome fireplace, piano, &c. The cabinet work of both these apartments is in the hands of Messrs. Wylie & Lochhead (who are completing this work from designs by Mr. T. L. Watson, F.R.I.B.A.), and will be of the most artistic description. The accommodation for the officers and engineers comprise a mess-room and pantry, seven rooms, bath, &c. The crew are berthed forward in a large forecastle, which is com-

plete with berths, seats, lockers, &c. The firemen's berths are amidships, and are entered off the engine-room. A bath is also fitted for their use. On the upper deck is a teak panelled house, containing the drying-room, chart-room, galley, photographic dark-room, scullery, and the companion house to main saloon. This latter is a handsomely-finished apartment, containing lounges, chairs, writing-table, piano, &c. In sidehouses amidships are the boot-room, larder, ice chest, cloak-room, &c. Electric light will be fitted throughout the vessel. The heating and ventilation of the cabins, to suit the varying climates to which the vessel will be exposed, have received special attention. The ventilation is effected by the ordinary method, and also by electric fans. These draw air through a system of conduits so arranged that any room can be shut off at will. The heating of the rooms is done by a complete system of hot water piping. For provisioning for long voyages there is a refrigerating chamber and machine. A large number of boats will be carried, including steam and electric launches, and two one-rating yachts. The vessel will be rigged as a two-masted schooner, with square sails on the foremast. The builders' firm have also made the machinery. The engines are of the triple-expansion type, with cylinders 23 in., 38 in., and 64 in. by 36 in. stroke. With these it is expected that the vessel will develop a high rate of speed. Captain William Matthews will take command of the *Rona* when completed.

LAUNCH—Irish.

Staffordshire.—On December 7th, at nine o'clock, the large steel twin-screw steamer *Staffordshire* was launched by Messrs. Harland & Wolff, from the south end of the Queen's Island Shipyard. She has been built for Messrs. Bibby Bros. & Co., of Liverpool, the senior member of which, Mr. Arthur W. Bibby, was present at the launch, and will form one of their line of steamers trading with Burmah. The gross tonnage of the *Staffordshire* is about 5,750. She will have four masts, schooner rigged, and be equipped with powerful steam windlass, steam winches, patent steam steering gear, and steam fans for ventilating the cargo holds, thus preserving the cargo from damage by heat. The vessel will have accommodation for about 104 cabin passengers. The saloon will be on the upper deck, smoke-room on bridge deck, ladies' room on promenade deck, the staterooms being on upper deck and bridge deck. Ample provision will be made for the comfort of passengers, including mechanical ventilation of saloon, and refrigerators for ensuring supplies of ice and fresh provisions, while the electric light will be provided throughout the ship. The machinery consists of two sets of triple-expansion engines of the most modern type, made by Messrs. Harland & Wolff.

TRIAL TRIPS.

Netherlands.—On November 21st the steel ferry steamer *Netherlands*, built by Messrs. T. S. Marvel & Co., Newburgh, N.Y., U.S.A., for the Hoboken Ferry Co., was taken for her trial trip. The vessel is 209 ft. long, 42 ft. beam, 62 ft. beam over guard, and 17 ft. deep, with a gross tonnage of 1,129. Motive power is supplied by two sets of compound engines, having cylinders 18 in. and 38 in. diameter, by 28 in. stroke, constructed by Messrs. W. & A. Fletcher & Co., Hoboken, N.Y. At the trial a speed of 12·4 miles per hour was attained.

St. Brieuc.—On December 11th the trial trip of the new screw steamer *St. Brieuc* was run, built to the order of Vicomte Le Guales de Mezaubran, by Messrs. J. Jones & Sons, of Liverpool. The dimensions of the steamer are:—Length between perpendiculars, 158 ft.; beam, 24·6 ft. (moulded); depth, 12 ft.; she is about 400 tons gross, and is intended for the passenger and cargo trade between Havre and St. Brieuc. She is fitted with triple-expansion engines, cylinders 14 in., 22 in., and 36 in. respectively, having 2 ft. stroke. On the trial a speed of 12 knots was attained, with a working pressure of 160 lb., 98 revolutions, and 420 I.H.P., an ample supply of steam being given with partially closed dampers the greater part of the trip. The boat is fitted to accommodate about 40 first-class passengers, and 20 second-class.

Nagy Lajos.—On December 11th the *Nagy Lajos* went for a trial trip off the Tyne. This steel screw-steamer has been built to the order of the Royal Hungarian Sea Navigation Co., Adria, Limited, of Fiume and Budapest, by Messrs. Wigham Richardson & Co., at their Neptune Works, Newcastle. She is 285 ft. in length by 38 ft. beam, and is fitted with triplex-expansion engines, which during the trial worked without the slightest hitch, driving the vessel at a good speed.

Greenbrier.—On Tuesday, December 12th, the last of the three large cattle steamers, built by Messrs. Furness, Withy & Co., Limited, Middleton Shipyard, Hartlepool, for the Chesapeake & Ohio Steamship Co., Limited, was taken out to sea for trial trip purposes. These vessels, which we fully described some time ago, are all built in excess of the requirements for the highest class at Lloyd's, and besides having large measurement for deadweight cargo, special and superior arrangements have been made in the 'tween decks for carrying live cattle. Very great care has been taken in the design of the ships to build them for the heaviest Atlantic work. On account of the unfavourable weather a lengthened trial trip was not possible; but the engines, which were built by Messrs. T. Richardson & Sons, Hartlepool, and all the other machinery worked very satisfactorily. We have no doubt this vessel, under the able command of Captain Boig, will keep up the record the two sister ships have made in the same trade. We are pleased to note during the last few years the large number of vessels of a superior class that have been built at this port.

Bahaduri.—On Tuesday, December 12th, the new steamer *Bahaduri*, built by the Ailsa Shipbuilding Co., and engined by Messrs. Dunsmuir & Jackson, Engineers, Govan, for Messrs. Shepherd & Co., Bombay, left Troon for her trial trip on the measured mile off Skelmorlie. The *Bahaduri* has been specially designed for the passenger and cargo trade on the Indian coast. Her dimensions are 255 ft. by 36 ft., beam, by 22 ft. 6 in. to spar deck, and she will carry 1,900 tons deadweight. She is fitted with six hydraulic cranes by Fullerton, Hodgart & Barclay, Paisley, a complete installation of electric light by J. H. Holmes & Co., Newcastle-on-Tyne; is divided into watertight compartments with instantaneous closing doors as, required by Board of Trade bulkhead rules; and is otherwise fitted up with all the most modern improvements for the safety of the vessel, quick discharge of cargo, and comfort of passengers. Her machinery consists of a set of triple-expansion engines having cylinders 20 in., 33 in., and 55 in. by 36 in. stroke, and two large double-ended boilers, with twelve furnaces, fitted with brass tubes, working pressure 200 lbs., the propeller blades being of Stone's bronze. She is also fitted with Weir's feed pumps, heater and evaporator. Throughout the day the engines worked with entire satisfaction, and developed about 2,000 I.H.P., the speed being about 13½ knots. She left next day for Bombay, via Cardiff.

Hotham Newton.—On Wednesday, December 13th, the s s. *Hotham Newton* left the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesbro', for her official trial trip. This vessel has been built to the order of Messrs. J. M. Lennard & Sons, of Middlesbro', for the purpose of carrying oil in bulk. She is of steel and takes the highest class of Bureau Veritas and Lloyd's, having been built under special survey. The principal dimensions are:—Length, 322 ft.; beam, 41 ft.; depth, moulded, 26 ft. 6 in. The spar and main decks are of steel and the poop and forecastle decks of pine. She is rigged as a three-masted schooner. The hull is divided into tanks, for the carrying of oil, by 13 transverse bulkheads and a centre line bulkhead which runs right fore and aft. Water ballast is provided for under the engines and boilers and pump-room, and also in the fore and after peaks. The ballast tanks are all protected by Messrs. Wailes, Dove & Co.'s patent bitumastic enamel and the bunkers are coated with this firm's bitumastic covering. This is the first oil steamer built on Kendall's patent system of expansion trunkways for controlling the oil cargoes under varying degrees of temperature. These trunkways allow a clear space in the *middle* of the ship for the stowage of coal and general cargoes, as they are fitted at the sides of the vessel instead of on each side of the centre line bulkhead as in previous systems. A coffer dam is provided at each end of the oil tanks which can be rapidly filled with water in case of need. Hydraulic rivetting has been largely adopted in the construction of this steamer, and no felt or canvas has been used in securing the oil-tightness and watertightness of any portion, the caulking in all parts being "iron to iron." The vessel is

lighted throughout by electricity and this has been carried out by Messrs. Hayward, Tyler, & Co., of London, who have also fitted the oil pumping installation. For working general cargoes two steam winches are fitted. Handsome accommodation is provided in the poop for the captain, officers, and engineers, the seamen and firemen being berthed in the top-gallant forecastle. The whole of the accommodation is heated by steam and the cooking is also done by steam in order to avoid any risks from fire. The construction of the vessel has been carried out under the superintendence of Mr. R. Harkness, for the Bureau Veritas, Mr. A. B. Wilson, for Lloyd's, and Mr. M. W. Ruthven for the owners. The engines and boilers are placed right aft, and these have been fitted by the North Eastern Marine Engineering Co., Limited, of Sunderland, the cylinders being 24 in., 39 in., and 64 in., by 42 in., with two large steel boilers working at 160 lbs. pressure. A party of friends accompanied the owners and builders on the trial trip, and everything worked most satisfactorily, a speed of over 12 knots being attained.

Southwark.—The contract trials of the s.s. *Southwark*, built by Messrs. William Denny Brothers, Dumbarton, for the International Navigation Co., have lately been carried out on the measured mile at Skelmorlie. The results, we believe, more than answered expectations. One of the outstanding features in the engineering arrangements of the vessel is the new system of induced or suction draught (lately introduced by John Brown & Co., Limited, Sheffield), and the efficacy of which was carefully watched by a large company of practical gentlemen. The results attained on several runs were regarded as eminently satisfactory, the average speed being 16·33 knots. The steamer is intended to run between Liverpool and Philadelphia.

Kanawha.—On Thursday, December 14th, the *Kanawha*, the last of three cargo and cattle steamers built by Messrs. Alex. Stephens & Sons, Linthouse, for the line of the Chesapeake & Ohio Steamship Co., Limited, of London, made her trial trip in the Firth of Clyde. Everything went as successfully as in the cases of the sister ships *Rappahannock* and *Shenandoah*; and the *Kanawha* proceeded on the same day under command of Captain Maxwell, to Liverpool, to load for her first voyage to Newport News.

Reviews.

Resistance of Ships and Screw Propulsion. By D. W. Taylor. London: Whittaker & Co. 1893.

Messrs. Whittaker have got a very great authority to treat one of the most difficult subjects for their specialist series. Mr. Taylor is Naval Constructor to the United States Navy, and he treats of a subject which, truth to tell, we always regard with dread, even in other men's hands, as though it had no terrors for him. The magic of figures and formulæ are to abolish all doubts and all difficulties.

As is customary and right in such works, Mr. Taylor begins with definitions and explanation of symbols used, and here at once we feel that he is a member of the scientific branch and has no sympathy with seamen or their ways. He discusses the use of the word knot, and remarks that it is properly a unit of speed and not of length. Here of course he is absolutely right. But he goes on to say, "whilst as above stated, the word *knot* is properly restricted to denote a unit of speed, the expression *nautical mile* or *sea mile* is rather clumsy and tends to produce confusion. There is therefore observed a growing tendency to use the word *knot* in the sense of a nautical mile. This usage is convenient, and though strenuously opposed as a solecism by the grammatical purist and he amateur sailor, it appears probable that in time it will prevail." It is a fact we are never able to escape, that whilst naval science and engineering are exact sciences, their professors seem utterly unable to master the most elementary fundamental principles of exactness and cannot even be precise in their definition. The word "mile" may have several meanings in different places. A chair in a drawing room is somewhat different to a chair on the permanent way of a railroad. Yet the novelist does not insist that he must take some other expression than "chair" in his description of a house, and explain that "drawing-room chair" ...bersome," and that if he did not substitute for it the ...telpiece" people might think his heroine was sitting ...f iron. He uses the word chair alone, knowing that sensible people expect to find chairs in drawing-rooms for sitting purposes, and chairs on railways for their proper uses. So surely writers on these subjects might use the word mile, and as they treat of the sea, leave their readers to understand that when he speaks of a mile at sea he means a sea mile. The word knot is entitled to keep its meaning as much as any other word in the dictionary, and if those who stick up for "English as she is spoke" are to be pilloried for doing so there is an end of discussion. Mr. Taylor can achieve anything by carrying to its legitimate length this system of using scientific terms in a Pickwickian sense of his own.

It has been said that the French Naval Architects are depriving us of our pre-eminence in design, but it seems very probable that the Americans will outstrip the French. They are devoting their best abilities to the task and the whole range of what has already been done is ransacked in a book like the present to form a foundation for Mr. Taylor's work. The writings of the Froudes, of Lord Rayleigh, of Mr. Blechyden, of Barrow, and others are laid under contribution, and the performances of recent vessels (especially the United States steamer *Yorktown*), analysed for their bearing on his theories. We cannot now discuss these very thoroughly, but we feel sure that this will be a valuable and useful contribution to the literature on the subject, and it is certain that the more labourers there are in the field the sooner will some substantial result be gained towards the solution of these most complex questions.

Correspondence.

[It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—Ed. M. E.]

AUSTRO-HUNGARIAN PATENTS.—ALTERATION IN THE LAW.

To the Editor of The Marine Engineer.

Sir,—A great many patentees will be interested to know that it is practically certain that on and after the 1st January next two separate and independent patents, one for Austria and one for Hungary, will be required in lieu of the combined Austro-Hungarian Patent hitherto issued.

A Bill to this effect intended to come into force on that date has been filed by the Austrian and Hungarian Ministers of Commerce in their respective Chambers of Deputies, which Bill we are informed upon good authority is certain to be agreed to.

Whilst by the proposed separated patent practice of the two States the granting and prolongation of Austrian and Hungarian Patents will probably be more easily and rapidly effected than hitherto, yet at the same time the cost of procuring and keeping the same in force will be greatly increased, as two patents instead of one will have to be applied for and maintained.

It is therefore very advisable that inventors desirous of securing patent rights in Austria and Hungary should apply for their Austro-Hungarian Patents before the expiration of the present year.

We are, Sir, yours faithfully,
E. P. Alexander & Son.
Fels. Chartd. Inst. Patent Agents.

Dec. 10th.
10, Southampton Buildings,
London, W.C.

REMARKABLE VOYAGE OF A STEAMER.

To the Editor of The Marine Engineer.

Dear Sir,—I thought you would like to insert the particulars of a remarkable voyage to Melbourne of a steamer, so have forwarded same to you for your valuable paper. The following are the particulars:—The s.s. *Star of Victoria* is owned by Messrs. J. P. Corry & Co., of Fenchurch Avenue, London. She was built by Messrs. Workman, Clark & Co., Ltd., of Belfast, in the year 1886. Engined by John & James Thomson, of Finnieston Engine Works, Glasgow; is a triple job of 350 N.H.P.; steam pressure of 160 lbs. per square inch. Is chartered by Messrs. Tyser & Co., in the frozen meat trade; from New Zealand,

carrying 46,000 carcases. She made the most remarkable passage on record to Melbourne. She left London, Royal Albert Docks, Sept. 7th, 1893, at 9.30 a.m., arriving into Melbourne Pilot Station at 6 p.m., Oct. 23rd, 1893, doing the voyage under 46 days. The most remarkable features on the voyage is the consumption of coals only being 25 tons per day, driving a 60,000 cubic ft. refrigerating machine every other day, or at least four days per week of two hours per day, and condensing water for ship's use every 10 days, so the consumption for main engines would only be 24 tons per day. The speed with such a small consumption is remarkable; there is also a remarkable coincidence: the engines were never slowed or stopped during the whole voyage, from leaving London Docks to Pilot Station at Melbourne, a record worthy of attention and credit to the engineer for the careful way in which the overhauling was done while in harbour. Thanking you very much if you will insert same in your valuable paper, as it is worthy of credit. Hoping I am not intruding on your valuable time and paper,

I remain, Sir, yours obediently,

s.s. *Star of Victoria*, W. G. Nixon,
Melbourne, Oct. 24th, 1893. Chief Engineer.

IMPROVED RESCUE THE DROWNING APPLIANCES.

To the Editor of The Marine Engineer.

Sir,—In 1874, a retired French *douanier*, or Custom-House Coast-guard, Lieutenant Brunel, invented a system to rescue the drowning which has long been successfully adopted in France, and has many advantages over the antiquated pole-axe-drag and the ring life-buoy, so often useless. Acting on my suggestion, the Brighton Corporation has just put up several "*Brunel*" Life-Saving Stations, which are the most efficient and economical apparatus to rescue the drowning by light portable hand-instruments (in whose manufacture and sale I have no commercial interest). As these appliances can now be investigated on the Brighton Beach, it is to be hoped that the Brunel system will be generally introduced and used along all water-side premises in the United Kingdom, and also in boats, barges, fishing-smacks, small vessels, &c. I am Sir, yours &c.,

J. Lawrence Hamilton, M.R.C.S.

30, Sussex Square, Brighton,
November 28th, 1893.

ADVANTAGES OF FLANGED WORK.

To the Editor of The Marine Engineer.

Sir,—The letter from Mr. James Sellar in your December number is extremely interesting reading, more especially to shipbuilders, who have had great difficulty in inducing Lloyd's to agree to flanging.

Last week I had the opportunity of seeing a large vessel in dock, built by one of our best shipbuilders, which had been stranded. The repairer gave me exactly the same information, as to the advantages of flanged work, which Mr. Sellar draws attention to.

In regard to the custom of cutting large manholes in the floors, this is undoubtedly done for the purpose of lightening the work. Lloyd's are continually trying to have these manholes made smaller, but for my part I think the general practice is quite sufficiently small.

In the case Mr. Sellar refers to, they appear to have been abnormally large; but after all the damage resulting was not serious, and it may have been better that the floors collapsed rather than the inner bottom should have been damaged. I know that this is the view held by some of our most expert Naval architects.

Lloyd's do not require any encouragement to make what Mr. Sellar calls a "bulky volume" any more bulky; the endeavour should rather be in the opposite direction.

Yours truly, A. Denny.

Dumbarton, Dec. 8th, 1893.

ADVANTAGES OF FLANGED WORK IN SHIPBUILDING.

To the Editor of The Marine Engineer.

Dear Sir,—In your last month's issue I was pleased to see a letter from Mr. Sellar, of Singapore, commenting upon the advantages of flanged work *versus* riveted work. The experience of Mr. Sellar only confirms what the writer has repeatedly proved during the last 12 years by a number of elaborate tests, and also from the number of damaged ships that have been repaired by him, in which flanged work, although distorted in every conceivable way, has stood its work well; whereas, in the case of riveted work, the rivets have sheared. This was most prominently brought into notice in the repairs to the steamer *Zanzibar*, which you commented upon. If Mr. Sellar is in this country at any time I shall be glad to show him steamers, into every portion of which flanged work has been introduced to increase the strength of structure by dispensing with riveting.

I notice that Mr. Sellar remarks upon the large-sized manholes that are cut through floor-plates, and thinks that these ought to be reduced in size. But really the difference in weight of material would be so little that I hardly think, if his suggestions were carried out, they would make any appreciable difference in the bottom of a stranded vessel. In designing double bottoms for water ballast it is very necessary that they should be easy of access. This is not only desirable in order to get good workmanship, but to get rapidly and easily through the bottom to do painting or other work. If the cellular bottom is not easy of access, the floors, keelsons, etc., are neglected, and there is consequently very rapid corrosion of material, although at the same time I think when large manholes are punched through floor-plates that the material should be of reasonable thickness.

Ordinary cargo boats with cellular bottoms as now designed, are sufficiently strong to carry cargo, and in many cases, owing to deficiency of water in rivers, have to load and discharge aground, thus proving that for ordinary trading the bottoms are sufficiently strong. But the most difficult thing to contend against is a steamer running aground at a speed of say ten knos, which would represent a force of something like 70,000 foot tons striking the rocks. The very fact that centre keelsons, tank divisions, etc., which are all solid, collapse in a similar way to the lightened floor-plates, prove that no structure can be made strong enough to withstand treatment of this kind, indeed, in one case, where the writer repaired a vessel which was salved, the difficulty in salving was due to the solid tank divisions having started the inner bottom. I am of opinion if the inner bottom is made of extra thickness, it would really be an advantage for the floors to collapse, as times out of number, in ships built by the writer, the vessel has been saved by the inner bottom. In the case of the s.s. *Zanzibar*, *Merida* and other vessels which ran full speed on to the rocks, the floor-plates, keelsons, and tank divisions, irrespective of design, were carried away.

Yours truly,

G. W. Sivewright.

Middleton Shipyard.

Shipbuilding Material.—It is interesting to note that a large proportion of the steel required for the building of th Clan Line steamers will be made by the Barrow Steel Co., by the new process which has been described in the columns of the Marine Engineer already. Inasmuch as the plates produced by this process never cool from the time the molten metal leaves the Siemen-Martin's furnace until the finished plate is made there is a considerable economy in the production as the cost of fuel is lessened, and also there is a saving in labour. The opportunity will be given to test this, and to determine their excellence or otherwise, but already by Lloyd's and Admiralty inspectors' tests the plates are shown to be as good as when they are taken through the full process including the slabbing.

The Second-class cruiser "Forte."—On Saturday, December 9th, the new second-class cruiser *Forte* was launched from Chatham Dockyard. Her dimensions are:—Length, 320 ft.; breadth, extreme, 49 ft. 6 in.; and her displacement, at a mean draught of 19 ft., is 4,385 tons. She is to be fitted with a pair of three-cylinder triple-expansion twin screw engines, constructed at Chatham Dockyard, which will develop 9,000 I.H.P. under forced draught, speed 19½ knots. The armament of the *Forte* will comprise two 6-in., eight 4·7-in., and eight 6-pounder quick-firing guns, seven ·45-in. machine (Maxim) guns, and one 3-pounder and one 9-pounder rifled muzzle-loading guns. She is also fitted with two 14-in. fixed torpedo tubes—one forward and one aft—and two swivelling ones of the same size on the broadsides. The ship has a steel protective deck throughout her length, and an armoured breastwork 5-in. thick for the protection of her machinery.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from November 17th, to December 6th, 1893.

21690 A. Lupton. Safety covering for metallic storage cylinders.
21896 J. W. Spencer. Steam boiler furnaces.
21897 C. L. Wells. Ship railways.
21905 J. Stephens. Propellers.
21908 J. G. Barclay. Sight feed lubricators.
21918 J. Baldwin. Valves for pressure gauges.
21944 W. Wagstaff. Generating steam on ships.
22019 T. Armstrong. Propelling apparatus for ships.
22063 E. Fitch. Screw propellers.
22066 T. Kay. Paddle chain propeller.
22073 J. Wolff. Rapidly turning or stopping ships.
22117 E. J. Preston and D. W. McLaren. Ships' sidelights.
22135 J. Gwynne. Dredging apparatus.
22155 T. E. Bickle. Operating water-tight doors.
22181 J. Roots. Internal combustion engines.
22209 R. J. Field. Adjusting packing rings.
22215 W. Dicks. Screw wrenches.
22221 J. Morrison. Compounding a pair of engines.
22239 C. T. Gann. Water-tight doors for bulkheads.
22264 A. Hughes. Ships' azimuth or pelorous dials.
22267 W. Child. Screw propellers.
22326 W. Lilley. Drilling tools for boiler plates.
22345 T. Dargue. Propulsion and steering of steamships.
22368 G. F. Simms. Anchors.
22374 E. E. Wigzell. Mariners' compasses.
22376 A. E. Harms. Feed regulators for boilers.
22406 A. A. Rickaby. Filtering water for boilers.
22484 M. E. Teague. Valve for steam, &c., uses.
22501 W. Carrington. Metallic pistons.
22506 J. A. McKie. Water tube boilers.
22520 J. E. Hussey. Fixing covers of steam boilers.
22558 J. B. Davids. Marine vessels.
22568 A. F. Kingsley. Boiler furnaces.
22569 J. W. G. Ross. Cover for manholes.
22571 E. Reynolds. Marine propeller shafts.
22573 I. Smith. Rotary engine, pump, siren, &c.
22574 J. Angus. Closing water-tight doors.
22581 B. J. B. Mills. (La Societé Compère Jeune, Faucher & Cie, France.) Lubricators.
22617 J. Symington. Flanged pipes and tubes.
22625 R. D. Smillie and W. C. Wallace. Fixing pipes to flanges.
22644 E. Jordan. Preventing shaft corrosion.
22700 W. Cochrane. Propulsion of vessels.
22749 F. A. Knapp and R. Hainsworth. Ships.
22750 F. Thiry. Ships.
22775 R. Mills. Steam generators.
22776 J. & G. Weir. Evaporators and boilers.
22787 T. B. Dawe. Docks or locks for ships, &c.
22812 R. B. Painton and W. G. Elliot. Propellers.
22819 J. H. Pollard. Stoppers for boiler tubes.
22846 J. I. Thornycroft. Tubulous steam boilers.
22850 G. W. Thomas. Warship.
22859 M. M. F. Richter. Calming waves of the sea.
22930 A. G. Melhuish. External combination engines.
22947 E. A. Jeffreys, H. Sheridan, and T. Beevers. Obtaining motive power from the action of tides.
22949 A. Blechynden. Tubular steam boilers.
22951 G. Kieffer. Self-sustaining pulley blocks.
22973 J. G. Grose. Oil reservoir and lubricator.
22982 J. W. Reed. Steam generators.
23005 J. Weir. Steam boilers.
23053 W. Arnold and W. Crowther. Lubricating bearings.
23060 S. F. and P. Smith. Ship door hooks.
23079 L. Richards. Steam engine cylinders.
23091 J. W. Brooke. Steam capstan construction.
23094 F. W. Golby. (G. Berni, Germany.) Water gauges.
23113 G. J. Snelus. Chains.
23132 J. Y. Johnson. (J. P. Serve, France.) Steam generators.
23134 A. W. Abbott. Ship's boat, davit, and skid.
23140 J. Byrd. Slide valve of steam engines.
23153 G. J. Wilson. Stockless anchors.
23171 W. Schmidt. Tubular boiler and heater.
23188 J. Crow. Boring bolt holes in shaft couplings.
23222 A. A. Vicard. Steam boilers.
23293 G. Greaves. Combination of furnace tubes.
23303 A. J. Boult. (J. Lecoq, Belgium.) Accumulators.
23306 T. Potterton. Range boilers.
23314 O. J. Edzards. Furnaces.
23316 T. Blissett and H. S. Fearon. Valves, &c.
23329 D. B. Morison. Boilers.
23358 F. M. and C. H. Wheeler. Condensers and tubes.
23406 R. A. Breul. Chain links.
23403 W. Cross. Water tube steam generators.

BOARD OF TRADE EXAMINATIONS.

EXTRA FIRST CLASS.

November 18th—S. Houghton—Ex. 1C London.

NOTE.—1C, denotes First Class; 2C, Second Class.

November 18th, 1893.

Armstrong, W. 2C N.Shields
Bone, Edward.. 2C Falmouth
Bull, A. N. .... 1C London
Dodsworth, J.G. 2C „
Downing, W. R. 1C Cardiff
Featonby, J. .. 2C „
Grimwood, C.T. 1C „
Howell, W. .... 1C London
Laird, J. ...... 2C „
M'Leod, H. .... 1C N. Shields
Robinson, R. .. 2C Liverpool
Robson, W. H. 1C Bristol
Rundle, R. .... 1C Cardiff
Samara, C. .... 2C Cardiff
Smith, E. J. .. 2C Bristol
Stepto, A. H. .. 2C London
Thomson, R. .. 1C „
Trevallion, C.W. 1C „
Welch, D. B. .. 1C „
Weston, W. .... 1C Liverpool
Wightman, A. 1C N.Shields

November 25th, 1893.

Ashmore, John G. 1C Liverpool
Balles, Jno. M. 1C W.Hartpl
Bridges, Geo. H. 2C Liverpool
Bruce, David .. 2C Glasgow
Colquhoun, John 1C Aberdeen
Colsie, James .. 1C „
Cromwell, J. W. 2C Glasgow
Dey, Jas. R. .. 1C Aberdeen
Gilchrist, Wm. 1C W.Hartpl
Gisfillan, R. L. 1C Glasgow
Gordon, Jno. .. 1C „
Greig, Wm. B. 1C Liverpool
Grimsby, Wm.H. 2C Bristol
Haughton, Hy.B. 1C Liverpool
Hayes, Robt..W. 1C London
Hough, E. R. .. 1C „
Legg, Wm. S. .. 1C Aberdeen
Maccoy, R. F. .. 2C N.Shields
Macdonald, J. F. 1C Glasgow
Menzies, Geo. .. 1C „
M'Kenna, Jas. .. 2C W.Hartpl
Mooney, T. W. 1C London
Ogden, C. C. .. 2C W.Hartpl
Page, Joseph .. 1C London
Pappa, John G. 1C Liverpoo
Parkinson, W.B. 1C London
Platt, George T. 2C Liverpool
Rowland, Wm.O. 2C Bristol
Sparks, Alfred E. 2C Liverpool
Stanger, Jas. J. 1C Glasgow
Stewart, George 1C Liverpool
Thornycroft, J. 1C „
Wilson, Alfred 1C W.Hartpl

December 2nd, 1893.

Bowman, Ths.A. 2C Cardiff
Bunbridge, E.H. 2C Hull
Clayton, John.. 2C „
Constant, Wm.J. 2C London
Cooper, Sidney 2C N. Shields
Davies, Ths. J. 1C Cardiff
Duncan Wm. S. 1C London
Hedworth, Jas. 2C N.Shields
Jeffrey, Jas. S... 2C Hull
Jungersen, W.F.W. 2C N.Shds
Ledder, Richard 1C Cardiff
Murdock, John.. 2C Liverpool
Penman, John T. 2C N.Shields
Pollock, Chas. E. 2C „
Quick, B. A. .. 2C London
Ramsay, Wm.G. 2C N.Shields
Robertson, A. P. 1C Liverpool
Smart, Wm. T. 2C Cardiff
Snook, George 1C London
Tomlinson, S. B. 2C Liverpool

December 9th, 1893.

Bishop, Thos. H. 1C Liverpool
Burls, Chas..... 2C London
Dunn, Jno. .... 2C N.Shields
Evans, Jno. H. 2C London
Ferguson, Wm. 2C Liverpool
Fitzpatrick, M.J. 1C Glasgow
Hartnell, Geo.S. 2C London
Miller, Jno. .... 2C Glasgow
Pattison, Jno.W. 1C N.Shields
Riddell, Neil .. 1C Glasgow
Ross, Andrew .. 1C Liverpool
Ross, Chas. F. .. 2C London
Shaw, James .. 1C Liverpool
Shearer, James 1C Glasgow
Smith, James .. 2C London
Stark, Thos. .. 2C „
Wood, Herbt. E. 2C Glasgow

The Marine Engineer.

LONDON, FEBRUARY 1, 1894.

SINCE the sad disaster between the *Camperdown* and *Victoria*, the subject of the ram as a weapon of warfare has had considerable attention directed to it, and Mr. Laird Clowes has added a contribution of statistics taken from 74 cases of intentional ramming, in a paper read before the Royal United Service Institution. The author advances that many, if not all, naval officers are gradually forming an opinion that the ram is a weapon of great efficacy, and that given slight superiority of speed and good handling, one ship can, without much difficulty, be made to ram another, even when that other is under full control and has plenty of sea room in which to manœuvre. Mr. Laird Clowes, however, submits that the statistics he has prepared and submitted to the Institute point rather to the opposite conclusion, viz., that if two ships have sea room and are fully under control, it appears to be practically hopeless for one to effectively ram the other. This view he supports from collected examples of 32 cases of intended ramming, where the ship attempted to be rammed was under steam with plenty of sea-room, in which 26 of these threatened vessels were not touched or injured at all, and the remaining 6 were only slightly and one seriously damaged, but none to the point of sinking or disablement. In addition to this also, it is pointed out that where a vessel attempted to ram under such conditions the resulting risk and actual damage to herself, where actual collision was effected, was more serious than to the vessel rammed. Probably this serious risk to the rammer is as great in narrow waters as in the open sea, and we would suggest that this liability of damage to the rammer is due to the velocity of the rammed vessel causing an oblique shear upon the ram and bows of the ramming vessel. With the present rapid development of torpedo appliances, as also of the quick-firing light guns, very effective at close quarters, and the heavy breech-loading guns, the dangers to a vessel closing upon the quarters or broadship of an opponent for ramming will for the future be much increased. It would appear, therefore, that there is little probability of the ram being used effectively in a naval battle in the open sea, unless upon disabled vessels, and in that case it may well be asked, where would be the advantage of sinking an opponent which may be captured and thus added as a prize to the trophies of the victors. With the modern development of torpedoes, a vessel whose guns have been silenced, and which has been disabled by an opponent's fire, may well be expected to surrender when helpless, when menaced in that condition by torpedo attack. Of the 74 cases cited by Mr. Laird Clowes, only 15 vessels were absolutely lost, including 2 of those who rammed, the remaining 13 cases of rammed vessels sunk thereby is but a small percentage of the whole cases. Seeing the risk also to the ramming ship it would be a very questionable action on the part of her commander to use his ship at such a risk by ramming, except in the last resort. We have in a former issue, shortly after the disaster to the *Victoria*, ourselves suggested that a small vessel used as a rammer at high velocity would be as effective as a larger ship at a lower velocity of impact, and would run infinitely less risk to herself of injury than the larger vessel striking at a lower speed. We are glad to see that Mr. Laird Clowes supports this theory, and suggests it possible that small vessels especially constructed for the purpose with high speeds should be used for ramming, should that mode of warfare commend itself to the naval authorities. The degree of penetration of a ramming ship would increase as the square of the velocity of impact, and the reaction in the shape of destruction upon the ramming vessel would also be in the same inverse ratio. Hence the injury to the ramming vessel will always be more conspicuous in accidental collisions where the speed is slackened to reduce the impact. Admiral Nicholson, in discussing the subject presented by Mr. Laird Clowes, seemed to think that there was little confidence amongst naval men in the design and strength of the rams as at present constructed in line-of-battle ships, and advocated separable rams. This idea of separable rams was not, however, received with much favour by others, and we do not think that the removability of the ram would be much protection in times of peace, as an ordinary cut-water would answer all purposes of destruction, and separable rams would be but a cause of weakness in warfare and not save shock or destruction to the ramming hull. Mr. Arnold Foster advocated the retention of the ram as a weapon of warfare, but constructed in a more scientific manner, and employed under proper conditions. It appears that foreign countries are building vessels with the special object of using the ram, and it therefore behoves England to decide promptly upon the whole subject as to its value as a weapon of offence, and the best scientific conditions for its construction and employment.

THE agitation set going by the Institute of Marine Engineers, for the recognition by an official certificate of the third engineer, and for a more comprehensive qualification for the second grade certificate, is slowly but surely bearing fruit. The resolution to this effect

passed at a meeting of the said Institute, on February 6th, 1893, has been transmitted to the Board of Trade, and this last body has very properly communicated this resolution and the accompanying correspondence to that other great representative body of marine engineers, the North-East Coast Institution of Engineers and Shipbuilders, for their consideration and comments upon it. The resolution in question is: "That in the opinion of this meeting it is highly necessary to amend the present regulations as to second-class certificates for engineers, with regard to service in the workshop, where the minimum service should be five years; and that the attention of the Board of Trade should be called to the desirability of creating a third grade certificate, which should be granted to those who have served at least five years in an engineering works, and one year at sea, and pass the prescribed examination." The North-East Coast Institution, in submitting this resolution to their members, very ably placed the whole question, pro and con, before them through a paper compiled by their vice-president, J. R. Fothergill, in which he first reviews the increased demands now made upon the proficiency, both theoretical and practical, of the whole staff of sea-going engineers, even down to the third, fourth and fifth grades in liners and ocean mail steamers. It would appear to be absurd that engineers who can show a qualifying apprenticeship, or service as a journeyman in workshops for at least five years, and supplemented with at least one year's service afloat, should not have a recognised official certificate as a third grade engineer, or that such engineers, when having served many years in such an inferior grade in the large mail or line steamers, are not eminently more qualified for second grade certificates than the present third uncertificated engineer who has had but three years' qualification in works, and one year at sea as an engineer, or on regular watch. On the one hand it is a question if such three years' apprenticeship in works, and one year at sea is a sufficient practical training to qualify for a second grade certificate, where practical experience in emergencies at sea, and absolute knowledge of how repairing work is to be done, and ability to do it, is so necessary; and on the other hand, where only three engineers are carried, it is most important that the third engineer, whether certificated or not, should be at least capable of taking off his coat and showing the men under him how good fitting and repairs are to be carried out under the direction of his superiors, so that the job shall be lasting and reliable. The whole comfort and success of a voyage may depend upon such knowledge of detail and handicraft skill in the third engineer in repairs hastily carried out by him in port. If shirked, or badly executed in detail, a break-down on the voyage is the natural result, and possibly enforced disablement at a critical moment in a gale, or on the lee shore. It is not intended that a third-class certificate should be compulsory upon all engineers serving at sea, but that such a certificate should be obtainable by, and granted to sea-going engineers who have qualified themselves for it by a sufficient practical training, and the experience of one year at sea, with the necessary technical and theoretical knowledge to pass an examination. This should be a distinct encouragement to the large body of third and inferior engineers of large practical experience who may not see their way to a second-class certificate. Similarly the increase of sea-going experience of from one year to two should be no hardship to the engineer who desires to be thorough in his profession, particularly when a third-class certificate is to be obtained at the end of the first year. We have no doubt that both these modifications will be quite acceptable to the marine engineers as a body, as it will place the third grade as the mere qualifying certificate, and the second grade certificate as marking a man of accepted experience in addition to his qualification in letters, and his power to cram for an examination.

It is a curious commentary upon the above resolution of the Mercantile Marine engineers as a body through their Institutes, that the Admiralty has been forced by the pressure of circumstances to admit next June 18 candidates as assistant probationary engineers who have only completed a four years' training instead of the usual five years course. It will be a strange result if the Mercantile Marine engineers of their own act insist upon a better qualification than the engineers of the Navy. It will be at least most creditable to the former, and will be an excellent corroboration of the statement that we have often advanced, that the Navy of Great Britain in the case of a great naval war will have to depend upon the Mercantile Marine engineers as a reserve to man their engine-rooms efficiently. The Royal Naval Reserve is supposed to be open and designed to attract these men, but it is no wonder that, with the absurdly stiff theoretical examinations required to qualify for a commission there are but very few mercantile engineers who write R.N.R. after their names. There will have to be a much better inducement offered in the shape of a retaining fee to induce men, at a time of life when mental cramming is not easy to face, the trouble of preparation for the qualifying examination, or the Admiralty must be satisfied with Board of Trade first-class or extra-first certificates, combined with undoubted experience and high character. The latter course is that we should suggest as one calculated immediately to bring good men into the ranks of the

Reserve, so that, in the event of war, the ships would have a chance of a full complement of experienced and reliable engineers in the engine-room.

CONVERTING COMPOUND ENGINES INTO TRIPLE-EXPANSION ENGINES.

In the adjoining illustrations we show a very ingenious system of converting compound engines into triple-expansion engines which has been devised and practised by Messrs. Gourlay Brothers and Company, engineers and shipbuilders, of Dundee. The main object of the design is to produce a three-crank triple-expansion engine at a moderate cost which will be equal in endurance and efficiency to new triple-expansion machinery of modern design. This, Messrs. Gourlay Brothers & Co. have accomplished, for it will be observed that, by their plan, the three-crank arrangement is obtained without having recourse to increasing either the over-all or the soleplate length of the compound engines, which are being dealt with, thus entirely avoiding the large expense of rearranging bulkheads, engine seatings, and the structural alterations to the hull of the vessel.

Referring to the illustrations, Fig. 1 represents a perspective view of the engines, Fig. 2 a side elevation, and Fig. 3 is an end elevation of the same.

The method of conversion is as follows:—The old cylinders are removed from the columns, and three complete new cylinders are mounted thereon, the high-pressure cylinder being placed in the middle, with its valve chest dispcsed in front. The pistons of the three cylinders are connected to three cranks respectively, exactly similar to recently designed triple engines. The centre or third crank is placed in what was originally the low-pressure eccentric pit, the low-pressure link motion which was originally there, being removed to the after-end of the engine, directly under the new low-pressure valve chest, the valve of which it works direct. The original high-pressure valve motion is left in place and now directly operates the intermediate-pressure valve. The cranks are set at an angle of 120° to one another, which permits the omission of any special and independent

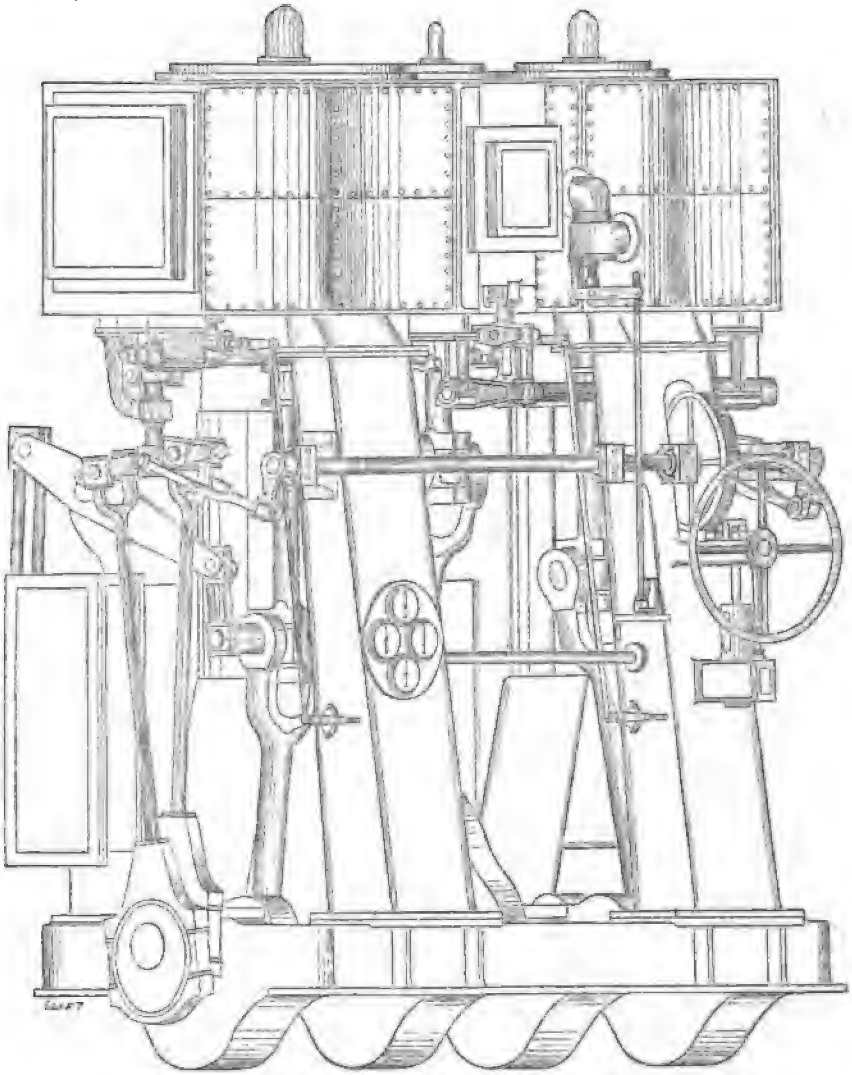
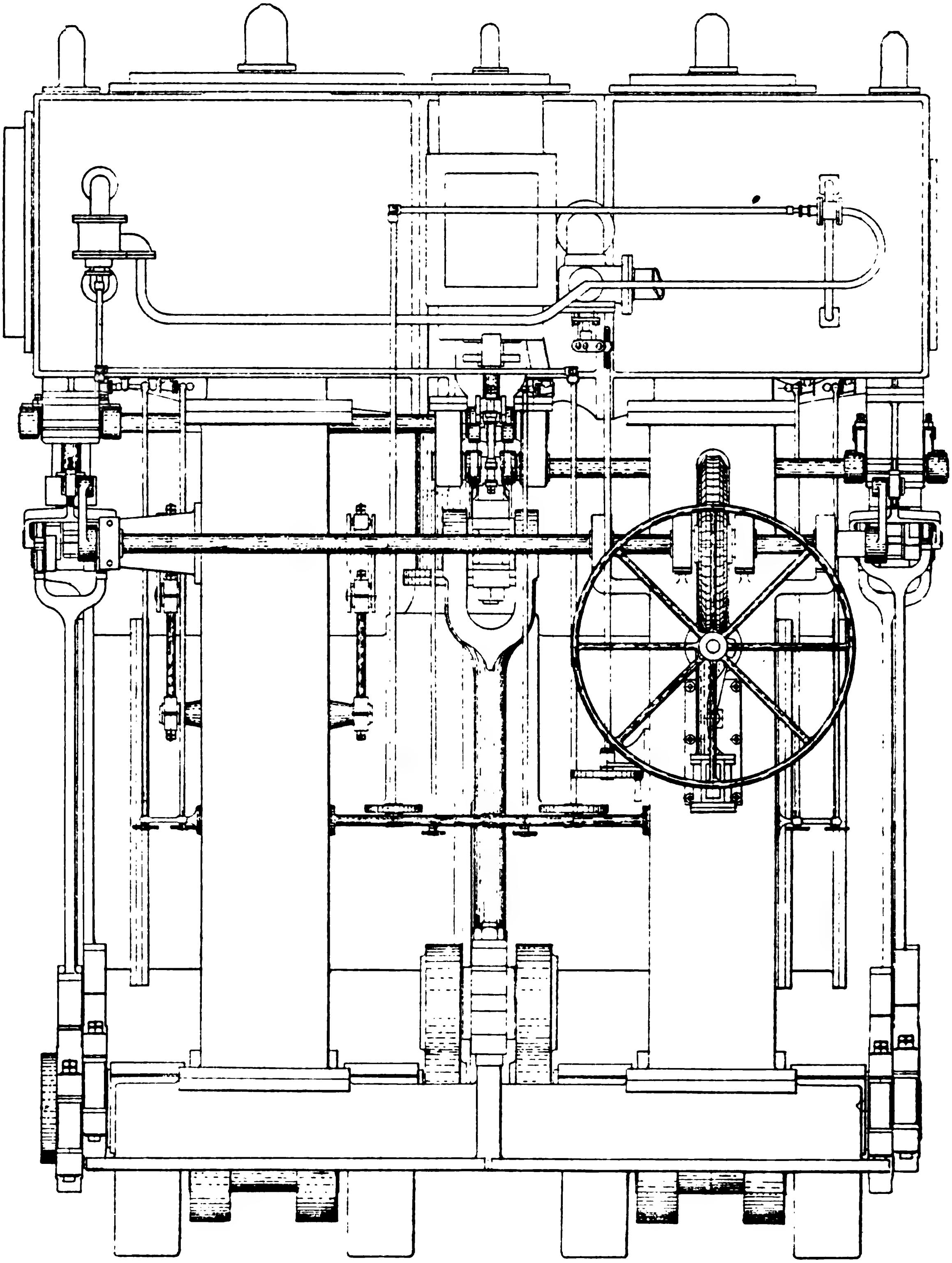
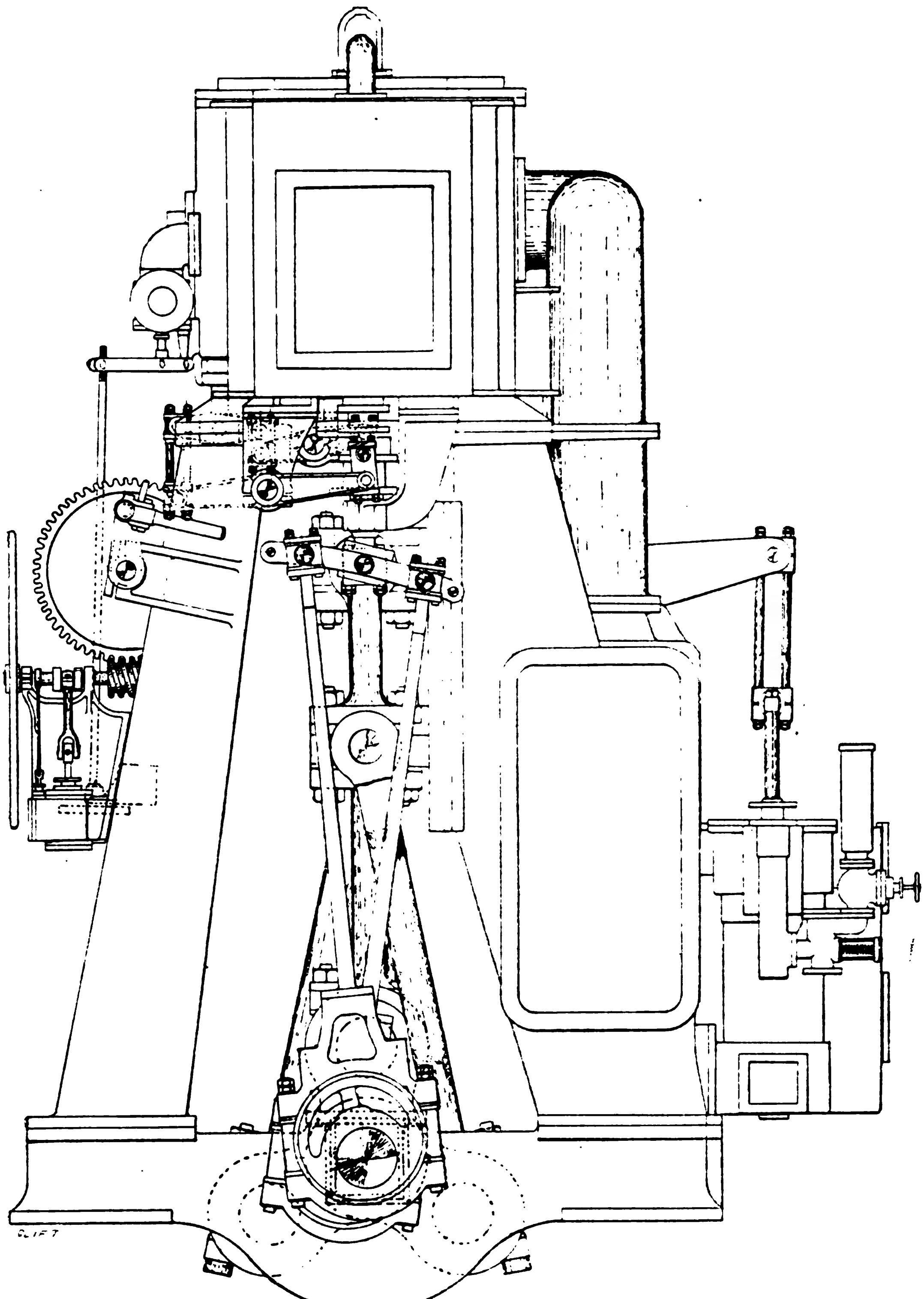


Fig. 1.



Triple-Expansion Engines. Fig. 2. (See page 459)



TRIPLE-EXPANSION ENGINES. FIG. 3. (See page 459.)

valve motion for operating the high-pressure valve, inasmuch as it can be operated by the combined motion of the other two valve gears.

To effect this, two rocking shafts are arranged, one of which is connected to and operated by the low-pressure cylinder valve motion, and the other rocking shaft is connected to and operated by the intermediate cylinder valve motion, through suitable links and levers connected thereto.

The lever at the inner end of each of the rocking shaft is connected to a beam, pivoted at its centre or thereabouts to the valve spindle of the high-pressure cylinder.

Now it follows that as the cranks are set at angles of 120 degrees from one another, it is necessary that the valve motions be disposed at the same angle with one another, and if the motion of the two gears be combined, the resultant motion from such combination if reversed in direction would be the same as regards the relative periodic movement as if the three motions were generated independently from points disposed on radial lines 120 degrees from one another about the axis of rotation.

It will thus be seen that by this method of conversion, the new parts necessary are much reduced, and we understand that the engines when completed are certainly equal to triple engines of modern design, whilst the cost of conversion is only about equal to that of adding an extra cylinder above the L.-P. cylinder.

It may be mentioned that the illustrations accurately represent the engines of several steamers which have been completed by the above firm, and the results from which, we understand, have been exceedingly gratifying to all concerned.

Our readers will, we feel quite sure, be much interested in this novel system of conversion, as in these days of keen competition rigid economy is necessary to obtain commercial success, and shipowners will be only too glad to consider any new plan by which they can improve the efficiency of their ships at a reasonable outlay.

INSTITUTE OF MARINE ENGINEERS.

THE TESTING OF BOILERS.

(Concluded from page 432.)

MR. J. H. THOMSON said the principal object or purpose of the paper, as he understood it, was to obtain information as to the advisability of testing up to high pressures, to get at the reasons for putting on double the working pressure for testing purposes, and to ascertain if it was really desirable, when testing old boilers, to go to the extent of applying double the working pressure. Now, they could not but recognise the wisdom in the early days of marine boilers, of testing up to double the working pressure. At about the time that the Board of Trade took the testing of boilers into their hands, the usual boiler pressure was from 20 lbs. to 25 lbs., but in those days the safety valve was a very primitive appliance as compared with that now employed. It was of very rude construction, and there were many different arrangements. In one form that was a good deal used one half of the safety valve weights were inside the boiler, the idea being to have the valve working on a pivot, so that there would be a minimum of vibration due to the working of the ship. Of course that was a very crude system, and it was always getting out of order. The deadweights, if they were left for any time, would get jammed up with rust, and they were never to be depended upon. They would thus easily understand the action of the Board of Trade in requiring a boiler to be tested up to double the working pressure. It was a simple matter to increase the pressure of steam from 20 to 40 lbs., and they still had a good margin of safety. In the old days very few engineers ever thought of starting their engines until they got their full pressure, and it was the duty of one of the junior engineers or a foreman to stand by the safety-valve. Immediately the engines were stopped the safety-valve was opened, and when the telegraph rang for the engines to go on again, the safety valve was closed. With these crude arrangements they could well understand a good margin of safety being required. But at the present day, or rather some few years ago, there was a feeling among boiler builders that this requirement of the Board of Trade was in excess of what was necessary. He never heard any complaints about the furnaces or the tube plates. It was principally in regard to the shell of the boiler that complaints had arisen. With the modern safety-valve, which he might almost call perfection, he could not see that they ran the same risk as in olden times; and he thought that the Board of Trade could with perfect safety allow a reduction in the thickness of the shell of the boiler. He was not quite sure, but he believed that the boilers in the navy had not the same proportions as the Board of Trade required for merchant vessels, and he contended that what was good enough for the navy should be good enough for the merchant service. The internal parts of the boilers might remain as at present, but many engineers were of opinion that they could do very well with a thinner shell.

Mr. Melsom said he failed to see why testing up to double the working pressure with cold water should be prejudicial to a boiler. When there was a steam pressure of 100 lbs. could any of them tell what the strain was on the boiler? The strain was certainly more than 100 lbs. Nobody could tell the strain due to temperature. In his opinion the test of double the working pressure with cold water gave a margin of safety which should certainly not be diminished. One of the speakers had given the case of an old boiler which was tested with cold water up to one and a half times the working pressure and proved all right, but when put under steam at the ordinary working pressure it burst, showing that the strain was greater with steam at a pressure of one than with cold water at a pressure of one and a-half. No one, he repeated, knew the stress due to temperature.

Mr. Fox said he did not believe that a new boiler was damaged by being tested up to double the working pressure by hydraulic pressure. The caulking of boilers under pressure should be done very carefully, especially in the case of old boilers, for unless care was exercised they were likely to do more harm than good. They might stop a leak at one part of the boiler and cause a very much larger leak somewhere else.

Mr. Turner contended that it was altogether a mistake to speak of caulking a boiler when it was under steam pressure. It was not caulking, but chintzing. By a little light tap they might stop a pin-hole, but that was not caulking. If they struck a hard blow they would probably start the seam right along.

Mr. H. C. Ward said that with regard to caulking a boiler during a test, or when filled with water, though many members seemed to think it was the best method of dealing with small leaks, Wilson, in his book on "Boilers," said that "however tedious it may be it is always advisable to empty a boiler before attempting to caulk up the seams." There seemed to be some difficulty with regard to the factor of safety. He did not think a factor of safety of 6 was at all excessive since the elastic limit was the thing to be kept in mind. Now the factor of safety measured the number of times the working pressure divided into the ultimate breaking stress and the elastic limit was about one-third of the ultimate strength. Hence in a boiler constructed with a factor of safety of six, if they tested double the working pressure they should have strained the material up to its elastic limit. Since, as was stated by Mr. Livesey and admitted by many others, so many unknown factors were at work, such as strains due to undue rigidity, staying, and unequal expansion, he did not think that with new boilers a factor of safety of six was excessive, or that with pressure below 100 lbs. a test of double the working pressure was too severe. With old boilers the case was somewhat altered; their condition and age must be ascertained, for though no wear or wasting was apparent and the boiler (as far as could be seen) was as good as new, yet there was an unseen factor to be dealt with. After many years of work the iron or steel, which was originally fibrous, had, through

the alternations of pressure and temperature, become somewhat crystalline, and though the boiler might be allowed to work at its original pressure it would, in his opinion, be very unwise to test it to double its working pressure. Mr. Livesey's paper pleaded for a better means of measuring deformations when under test, for if they could measure these deformations they could measure the forces which produced them, and thus obtain a measure of the internal stresses, about which they at present know so little. This he thought was what was wanted, and if it be possible to measure the velocity of light in a laboratory, surely some inventive genius could design an instrument which would correctly measure the alterations of form of a boiler, at least when under the cold or water test.

REVERSING SCREW-PROPELLERS.

A Meeting of the Institute of Marine Engineers was recently held at the Institute premises, Stratford, when a paper by Mr. Robert McGlasson was read on "Screw-Propellers, Reversing Screw-Propellers, and Non-Reversible Engines."

Mr. McGlasson, in the course of his paper, said: The propeller is the chameleon of marine engineering. We might as well search for a fixed spanner to suit all sized nuts, or a sail area that will suit all winds, as for a fixed propeller which will suit all conditions. The screws are of necessity continually operating under altered conditions of running, and the developed propulsive area, and the power to suit it, must be capable of change to meet them before we can expect to secure economical propulsion or can consider that we have obtained a screw propeller with which a marine engineer can be satisfied. We cannot, without risk, reverse the motion of the revolving masses constituting engines and propellers and shafts very quickly in a really quick-speed engine of any size. So I suggest that we let it run always at practically the same rate in one direction, whereby we shall not only gain mechanically, but commercially also. Increased revolutions, also, comprehend reduction in weight and space occupied, reduction in the weight of overhanging screws and fittings, and in the number and width of blades, and will permit of greater head of water under which the screws may operate. These suggestions have begun to be to some extent adopted in the more modern types, but much more can be safely done in this direction by the adoption of the reversing propellers and non-reversing engines. By these means we can also alter speed, stop, and reverse, the engines continuing to turn in but one direction, with only the necessary expenditure of power at whatever angle the blades may be placed. In short, we can hereby vary the developed propulsive area from the maximum to *nil* in either direction, thus insuring the utmost economy. The best modern practice has already corroborated the necessity of doing what is suggested; "trial and error" and "cutting and changing" of screws in "crack" boats still goes on, and provision is made in all the best new vessels of most nations for altering the pitch in dock. Provide for doing this in the water, to meet every condition, and with the engines running, so that the best pitch can be ascertained at speed, and the developed propulsive area altered to suit the then conditions of the ship and surroundings while running. With regard to the engines, to be able to discard a large quantity of gear and run always in one direction offers very material advantages, economically affecting the working, the wear and tear, and it also permits of simplification in the arrangement of various parts. Nothing is imported equal to what is discarded from the engine, for the gear required for the reversing propeller is only active when the developed propulsive area is being changed or reversed; not constantly—whether wanted or not—as the links, with their many vibrating points, are now. The change of direction of movement of the ship will be effected more rapidly and more directly; and as the direction of rotation of nothing—not even that of the screws themselves—is changed, the alteration is made smoothly, and without extra stress on either engines or propellers. The pressure is always in one direction on the guides, the brasses will greatly benefit, and "knocking" be prevented. In all the larger engines the whole of the links, the levers and reversing gear, way-shafts, several eccentrics and rods, and much other gear would be dispensed with, and many complications become unnecessary, and the merely manual labour be thereby much lightened. During the act of changing the position or angle of the blades from full pitch in one direction to full pitch in the other, the torsion strain upon the shaft cannot be increased, the speed of rotation may remain unaltered, and inertia—either of motion or of rest—does not come into play, and cannot affect the magnitude of the stress upon the moving parts. The complete reversal can—without risk of strain of any parts—be made in considerably less time than with reversible engines and fixed propellers, and no change in the direction of rotation of any parts is required. The reversal or manipulation of the blades may be effected from the bridge or any other part of the vessel as well as from the engine-room, on emergency or when desired, just as easily as the helm is now operated therefrom. The time occupied and risk in transmission of orders would be saved in the event of imminence of collision, fogs, &c. All sudden stopping and starting is detrimental to the machinery and boilers, and is avoided. Long experience has proved that the modification of the pitch of a screw may be made to effect considerable improvement in the speed of a ship or in the power taken to propel it at a given speed. It is also known that when a ship is lightly loaded, economic advantages attend the power of changing the pitch of the screw as compared with that which is used, and is best when the ship is fully loaded. For manœuvring purposes, entering and leaving port, navigating crowded rivers or estuaries, &c., this system will relieve the engine-room staff of a lot of orders closely following each other, often of vexatious contrarity, and always involving a lot of harmful reversal of stress—sometimes amounting to strains of engines, shafts, propellers, and boilers. In all cases the power is regulated to suit the developed propulsive area—in the case of steam by throttling all intermediate passages if necessary, or by varying the expansion—even while the blades are being turned for reversal, and this facility of feathering the screw blades and reducing the power employed while "hovering" will be of very great advantage to war-ships, and on occasion temporarily reduce the H.P. employed from thousands to hundreds. This power regulation is automatically effected while the blades are being turned, and is capable of further manual or motor adjustment when desired. The system will be productive of continuous economy, and will relieve the engineers of much onerous manual labour. Mr. McGlasson concludes: I seek safety for those who "go down to the sea in ships," and economy for those who do business in "great waters;" and I respectfully submit to your consideration a system that will ensure the utmost economy in screw-propulsion, that will save you much onerous manual labour and mental anxiety, that will give you more satisfaction in your work as marine *engineers*, and that will, on occasion, save both property and lives—your own perhaps included.

The paper has been read in London and Cardiff, and will shortly be read at Bombay, and possibly Calcutta also.

SEE'S PATENT HYDRO-PNEUMATIC EJECTOR.

We have referred before in these columns to the annoyance and vexation occasioned by the noise and dust raised, when hoisting ashes from the stoke-hold on board a steamer, and we have described devices to mitigate these evils, but we do not remember anything of a more simple nature than See's Patent Hydro-Pneumatic Ejector, which we illustrate in the adjoining diagrams. Referring to these diagrams, Fig. 1 is a side elevation of the apparatus; Fig. 2 is a plan of the same, and Fig. 3 the section of a steamer showing the apparatus fixed in place with the delivery pipe overboard.

The apparatus consists of a hopper into which the ashes to be thrown overboard are shovelled, and which is placed a little above the boiler-room floor, the bottom of the hopper is connected to the ejector, which has suitable connection from a pump and also a discharge pipe leading upward and outward to the side of the vessel above the waterline. The hopper is provided with a hinged lid, which makes a water-tight joint upon the same by means of suitable clamping screws. A regulating cock or valve is provided on the pipe from the pump, and a drain cock is situated at the lower portion of the discharge pipe. When at rest the lid of the hopper is kept closed, and the jet-cock as well as the drain-cock are kept shut. When

it is desired to work the apparatus, the steam is turned on to the pump. After sufficient water-pressure has been obtained in the pump, the jet-cock is opened and the lid of the hopper raised. The only work now to be performed by the firemen is that of shovelling the ashes into the hopper. The ashes in their fall through the hopper encounter the jet of water from the pump, and are forced up and out of the discharge pipe some distance clear of the vessel by the combined

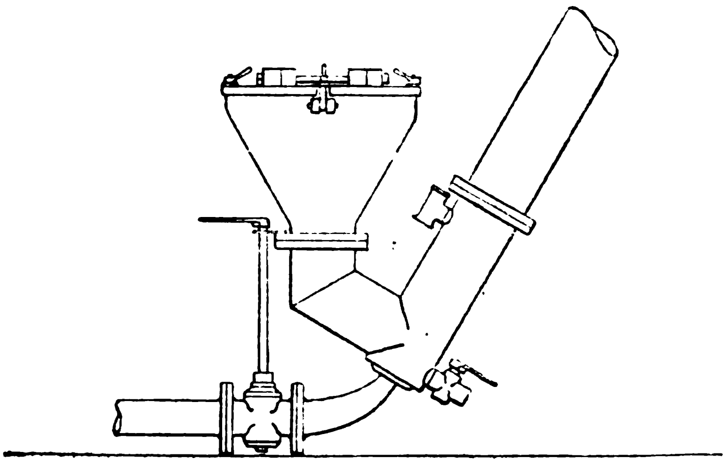


Fig. 1

action of the dynamic effect of the jet of water and the induced draught of air produced by the same.

After the work is completed the lid of the hopper is closed and secured before the pump is stopped. This, however, is not absolutely necessary, for the reason that if the jet-cock is closed very suddenly, the whole of the water in the discharge pipe is carried out therefrom by its own momentum, leaving the hopper, ejector, and discharge pipe practically empty.

The ashes being thrown out in a liquid condition with great force clear of the vessel, no matter what

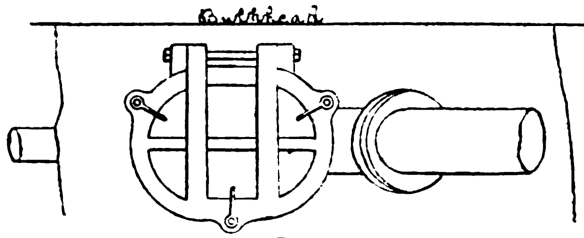


Fig. 2

the state of the weather may be, they will not be deposited on any part of the vessel, either above or below the waterline, and thus passengers passing fore and aft will not be soiled or drenched when the ashes are being discharged.

One of the important features which the apparatus possesses, is that it takes up little room and can be placed in positions where it would be impossible to introduce apparatus under any of the old methods.

It prevents one of the fruitful causes of trouble between firemen and sailors, and obviates the necessity of calling the watch to assist in removing the ashes, and on whatever ship it is used, it saves the firemen one of the hardest and most wearisome of their duties.

It may be interesting to note the following particulars as illustrative of the efficiency of this apparatus as compared with the old devices. The s.s. "*Lahn*," of the North German Lloyd's Steamship Co., was fitted with an ejector in the after stoke-hold. She has three stoke-holds with a railway leading from the forward and after ones into the centre one, so that coal can be carried to the centre one, or ashes taken from either the forward or after one. The railway was used to carry the ashes from the centre stoke-hold to the ejector. With the old system it took one hour each watch to hoist the ashes from the after stoke-hold alone; now with the ejector it takes fifteen minutes each watch to eject the ashes from the after and middle stokehold; that is, it took before, per day, one hour to hoist the ashes from a coal consumption of 45 tons, and now fifteen minutes suffices to eject the ashes from a coal consumption of 135 tons. The ship burns 180 tons per day. We understand that a second ejector has been placed upon the same ship. The illustrations show an exact representation of the ash ejector as fitted on board the White Star steamer "*Gothic*," the largest merchant steamer next to the *Great Eastern* that has ever been in the port of London. In this vessel the lift is very excessive, as the load draught is 27 ft. Nevertheless, we understand that the ejector which was supplied with a stream of water from one of the ordinary pumps in the engine-room, worked perfectly, and discharged the ashes twenty to thirty feet clear of the side of the vessel. This apparatus is being introduced by Mr. F. J. Trewent, Billiter Buildings, London, E.C.

We may add that it has been placed upon a great many steamships, and its use is attended with marked success in every case. Some of the most important shipbuilding firms in the kingdom have, after extended experience of its use, decided to fit this ash ejector in every steamship they build, and, we understand, have made arrangements accordingly. It is also being fitted on board the Hamburg-American vessels building at Belfast, the Russian Volunteer cruiser building on the Tyne, the *Campania*, now lying up at Liverpool, and a number of cargo and passenger vessels building throughout the country.

OBITUARY.

We regret to have to record the death of Mr. Thomas Carter, manager to the firm of Messrs. John Dickinson & Sons, of Palmer's Hill Engine Works, which position he had occupied for many years. This term of long service is evidence of the entire confidence reposed in him by his employers; and his kindness and just treatment of those under him, rendered him very popular amongst the workmen. He was well known in Sunderland and on Tyneside, and his death at the age of 53 years will be mourned by a large circle of friends. He leaves a widow and a family of five grown-up sons and daughters. The spectacle at the funeral was most impressive, the esteem in which the deceased was held by a host of people was strikingly manifested. In the funeral procession were fully 800 workmen from the works, and the carriages followed in considerable numbers.

THE JUNIOR ENGINEERING SOCIETY.

At a numerously attended meeting of this society, held at the Westminster Palace Hotel, on Friday evening, Jan. 5th, Mr. Percy J. Waldram in the chair, an interesting lecture on "Boiler Incrustations and Deposits" was delivered by Professor Vivian B. Lewes, F.I.C., F.C.S., Honorary Member.

The lecturer having pointed out the serious injury occasioned to boilers, and the waste of fuel due to the formation of incrustations, traced the history of various sources of water supply, and showed how the water acquired the power of forming deposits in steam generators. These deposits consist mainly of calcic carbonate, calcic sulphate, magnesic hydrate, and silica, the chemical processes which lead to their deposition in the feed-water differing in each case.

Calcic carbonate, which constitutes the principal ingredient in fresh water deposits, is thrown down in a dense form by the breaking up of soluble calcic bicarbonate under the influence of heat, and if it is nearly pure it forms a mud in the boiler, which can to a great extent be got rid of by blowing off.

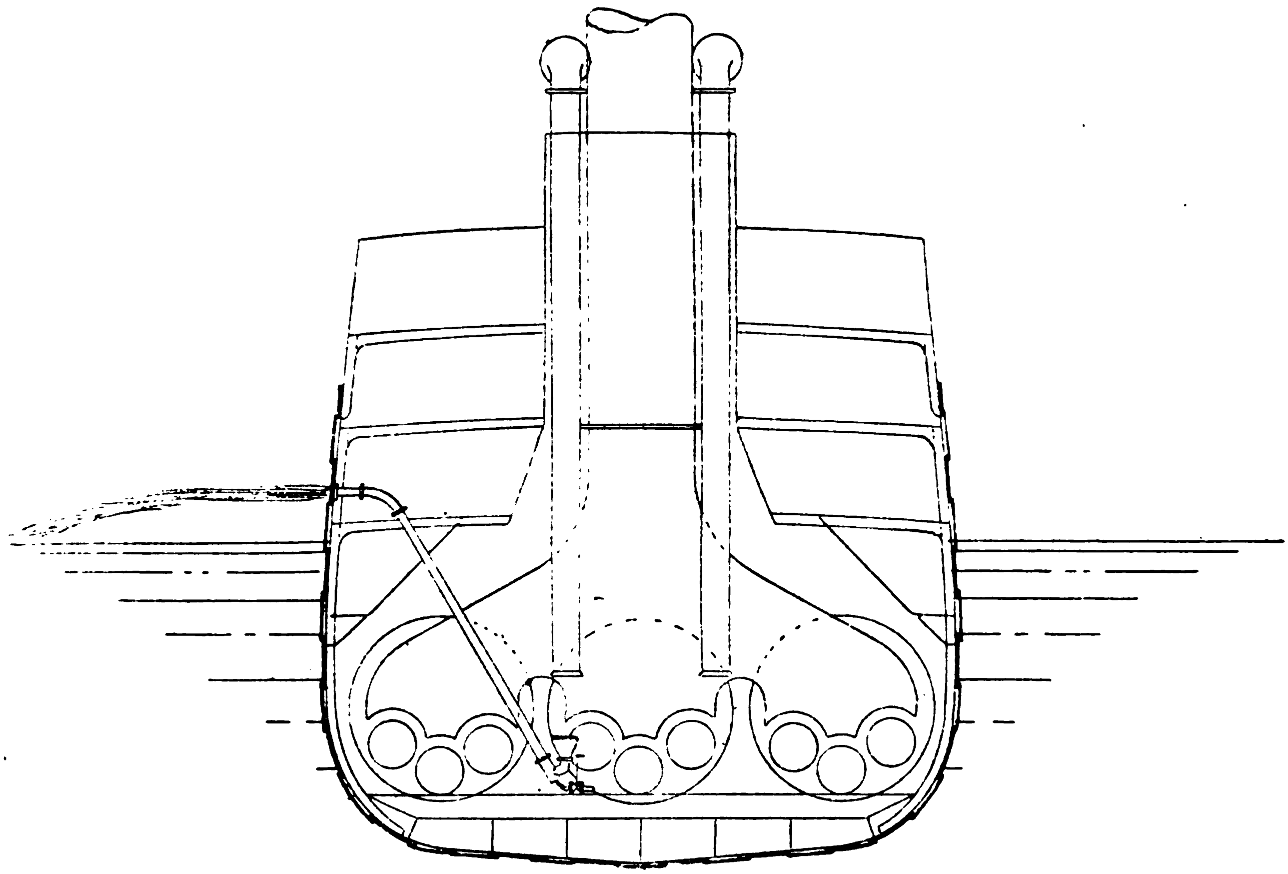
Calcic sulphate, however, is deposited by an entirely different action, as its solubility decreases with rise of temperature, high pressure, or great increase in the saline properties of the solution; and its wonderful power of hardening deposits and binding them together into an incrustation, which can only be removed by the use of hammer and chisel, makes it a most dangerous constituent of such deposits. This hardening power is due to the fact that it deposits from water in the form of small angular crystals, and in this form gets mixed with the calcic carbonate mud. As these crystals become heated, they lose water of crystallisation, and change their form into fine needle-shaped crystals, which bind the mass together.

Magnesic hydrate, which is found in many scales, has always been supposed to be due to decomposition of magnesic chloride at a high temperature, but this is a mistake, the magnesic hydrate being produced by the interaction of magnesic chloride and calcic carbonate, which results in the formation of soluble calcic chloride, evolution of carbon dioxide and deposition of magnesic oxide, which by combination with water forms the hydrate.

Examples were given of scales from various waters, and it was shown that fresh water incrustations may be looked upon as consisting chiefly of impure calcic carbonate, whilst the deposit, formed by the use of sea water is principally calcic sulphate. Brackish waters give incrustations consisting of nearly equal portions of these substances.

The question of oily deposits on plates was next considered and the lecturer pointed out that according to recent researches, mere wiping of a boiler plate with a greasy rag causes a serious diminution in its power of transmitting heat, whilst with an oily deposit one-sixteenth of an inch in thickness, plates in some cases became so overheated as to be unable to withstand the pressure upon them, and collapse of the furnace crowns sometimes ensued.

The question of anti-incrustators was then dealt with, and the lecturer expressed his opinion that if manufacturers were obliged to use a hard water, the most reasonable method they could adopt was to soften it on a large scale before putting it into the boiler, as otherwise serious complications would arise in the boiler itself.



See's Patent Hydro-Pneumatic Ejector. (See page 463.)

Gunboat Antelope.—Contrary to expectations, based upon some late trials of gunboats fitted with wet-bottomed boilers of the locomotive type, the first-class twin-screw gunboat *Antelope*, built at Devonport, and engined by Messrs. Yarrow & Co., of Poplar, when out on an eight hours' trial of her machinery—outside Plymouth breakwater—not only succeeded in developing a higher power than that contracted for with $\frac{1}{2}$in. of air pressure in her stokeholds, but attained—against a strong wind and heavy sea—a speed of over seventeen knots an hour.

Junior Engineering Society.—The ninth annual dinner of the Junior Engineering Society took place on January 26th, at the Holborn Restaurant. Mr. John Wolfe Barry, M. Inst. C.E., the president, was in the chair.

DIGEST OF RECENT DECISIONS OF THE HIGH AND APPEAL COURTS OF THE UNITED KINGDOM ON SHIPPING CASES.

Contract to Tow in relation to Salvage.

THE plaintiffs' tug was engaged for a certain sum to tow from sea and dock the defendant's ship. When the tug was under the direction of the pilot, turning the ship round for the purpose of entering the dock stern first, the tow-rope of another tug fast on the ship's quarter parted, and through the effect of the wind and the tide the ship touched the ground. By the pilot's order the plaintiffs' tug then shifted her position and proceeded to tow the ship into dock bow first, and in so doing the ship came off. The plaintiffs claimed salvage remuneration, alleging that their tug had rescued the defendant's ship from a dangerous position. The Admiralty Court held that the plaintiffs were not entitled to salvage remuneration, because the ship was not in any immediate danger, and the tug had not run any risk, or performed any duty or rendered any services beyond such as in the contemplation of the parties was reasonably to be expected of her during the existence of the towage agreement. In the course of his judgment on the case, Mr. Justice Barnes remarked that "while it is the duty of the court to take care to adequately remunerate all salvers for salvage services in order to encourage these services to be performed . . . it is equally the duty of the court to see where a towing contract has been made, that a little departure from the exact mode in which that contract is to be performed is not magnified so as to convert towage into salvage services."—*The Liverpool.*

A Question of Maritime Lien on Ship and Freight for Disbursements by Master.

It was agreed by a charter party for the hire of a steamship that the charterers should provide and pay for coals. During a voyage it was necessary to provide them to enable the ship to continue the voyage and earn freight. The master, who had notice of the terms of the charter party, obtained the coals for the ship at two foreign ports. The coals were ordered from a firm with whom the charterers had a contract to supply their steamer with fuel. The charterers were afterwards adjudicated bankrupts. In an action by the master against the ship and her freight for disbursements on account of this steamer, the House of Lords, on affirming the judgment of the Court of Appeal in Ireland, consisting of the Lord Chancellor, Chief Baron Palles, and Lord Justice Barry, decided that as the shipowners were not liable for the disbursements, the master had no maritime lien on the ship, and that although his claim for payment out of the freight was supported by considerations of equity he had no lien on freight, because according to the practice of the Admiralty Courts there cannot be a maritime lien on freight when there is no lien on the ship in respect of the same debt.—*Morgan v. Castlegate Steamship Co.*

Electric Launch used on Artificially Land-locked Water not a Statutory Vessel used for Navigation.

The appellants, who were the Mayor and Corporation of Southport, owned an artificial lake on the foreshore of that borough, being a land-locked lake only open to the sea at high spring tides in or abutting the park of Southport provided by them and laid out on such foreshore, and the lake had been excavated from the sand on the foreshore to the depth of 3 ft. or thereabouts, and was surrounded by a concrete wall or path. The lake is about half a mile long and 160 yards wide. It was used for boating, and the appellants had placed on it for hire a launch called the *Bonnie Southport*, of about three tons burden, capable of carrying twelve passengers and upwards. It was propelled by electricity from accumulators charged by a direct current dynamo from a charging station. This vessel had not been registered as a British ship under the provisions of the Merchant Shipping Act, 1854, nor had any duplicate of the certificate required by section 318 of that Act been put in any part of it as required by section 317, and no such certificate was in force on the 10th of August, 1892, or had ever been issued to the launch. This vessel on that day was propelled from the landing stage of the lake on a trip round it and back again to the landing-stage, and had on board about thirty or forty passengers, each of whom had paid to the appellants or their properly authorised officer the stipulated fare for the trip. On these facts the Board of Trade took out a summons for a penalty for the absence of such certificate as required by sections 317 and 318 of the statute referred to. The magistrates at Southport, sitting at Petty sessions, convicted the appellants and imposed a fine, but at their request stated a case for the opinion of the Queen's Bench Divisional Court, the question left for its decision was whether upon the before-mentioned facts the magistrates were right in holding that in point of law the launch so used came within the provisions of the Merchant Shipping Act, 1854, section 2 of which enacts that "'ship' shall include every description of vessel used in navigation not propelled by oars." The Queen's Bench Division Court decided that an electric launch used for pleasure trips on an artificially formed lake is not a "vessel used in navigation," within the meaning of this section, and therefore is not subject to the provisions requiring a certificate under sections 317 and 318 of the said Act in reference to ships therein termed "passenger steamers." The Lord Chief Justice observed that it is stated that the Public Health Act, 1890, provides sufficiently for the control of such launches as this. At any rate by section 44 of that statute, "public bodies are given power to provide for public recreation in boats and to make bye-laws for the public safety in that respect. Whether this launch comes under the strict term 'boat,' or not, at any rate the Corporation have, it is admitted, laid down by laws for its proper management, and the public are no doubt adequately protected in its use, and to bring such a pleasure vessel or boat as this under the stricter regulations of the Merchant Shipping Act would seem an absurd straining of a useful law."—*Reg. v. The Mayor of Southport and Morris.*

Unseaworthiness from Uncased Pipe, and Resulting Damage to Cargo.

By a bill of lading shipowners were exempted from liability for "any act, neglect, or default whatsoever, of pilots, master or crew, in the navigation of the ship in the ordinary course of the voyage." A cargo which was shipped thereunder was damaged from the want of casing in the pipe of a water-closet that was broken by the pressure of the cargo in rough weather. Before the commencement of the voyage, the master and crew had removed the casing and considered it unnecessary to replace it, and trusted to other means for the protection of the pipe. According to general practice in jute-carrying ships, such a pipe is cased before the cargo is loaded, and the ship starts on her voyage. After the ship was loaded the pipe referred to was not visible or accessible without the removal of a portion of the cargo. In an action at the instance of indorser of the bill of lading against the owners, the House of Lords held in reversing the decision of the Court of Session of Scotland, that without the casing on the pipe the ship was not in a condition to carry her cargo with reasonable safety, and as this defect should have been remedied before the commencement of the voyage, it was a breach of the implied warranty of seaworthiness by the shipowner who was therefore not protected by the terms of the bill of lading. Lord Halsbury in his decision remarked that it was not intended by any one that such part of the ship as was structurally defective "should be visited or interfered with or attended to in any way until the completion of the voyage. In the course of that voyage, without any unusual peril of the sea, the damage was occasioned to the cargo in the vessel by reason of that structural defect which existed at the time at the commencement of the voyage."—*Gilroy Sons & Co. v. W. R. Price & Co.*

Limitation of Liability in a Collision Case.

A collision occurred in the Thames between two steamships, named the *Petrel* and *Cormorant*, belonging to the same owners, and the latter sank, but there was no loss of life. In an action brought by some of the owners of cargo on the *Cormorant* against the *Petrel* the latter ship was found alone to blame. Her owners then began proceedings for limiting their liability to £5,658 5s on 707·28 tons, being £8 per ton on the gross tonnage of that steamer without deduction of engine and room, but deducting 31·80 tons crew space under section 9 of the Merchant Shipping Act, 1867, and in regard to their claim for lost effects making the masters, officers, and crew of the *Cormorant* defendants with cargo owners, and others. On an objection being made to the claim of the master, officers, and crew of the last named ship and to the deduction from the tonnage of the *Petrel* of the crew space, Sir Francis Jeune decided firstly that the masters, officers, and crew of the *Cormorant* were entitled to claim against the fund for their lost effects, because although they had a common employer with the master, officer, and crew of the *Petrel*, in the sense that both crews were making money for him, they were not in common employment in the sense that injury from the negligence of one crew was an ordinary risk of the service of the other, for the safety of the crew of one of these ships was not dependent on the skill and care of the crew of the other steamer sailing on the Thames. Secondly, that as the requirements of section 9 of the Merchant Shipping Act, 1887, had been complied with, the plaintiffs as owners of the *Petrel* in estimating the tonnage upon which their statutory liability was founded, were entitled to deduct the 31·80 tons crew space.—*The Petrel.*

Delivery of Ship in relation to Transfer of Risk to Purchasers.

A ship was built under a contract which stipulated that the price of it was to be paid in four instalments, the last to be paid when the ship was delivered and the builders' certificate handed over. As she was constructed, the vessel was to become the property of the purchasers. It was further agreed that she was to be delivered ready for sea and when delivered a model and certain certificates were to be furnished, but she was to remain at the builders' risk until handed over to the buyers', and until then the builders were to keep her insured. Captain Newell, part owner, expressed a wish to have the ship re-transferred to the crane berth, and on the builders stating their unwillingness to incur the risk of another move, an arrangement was made with Capt. Newell to have the ship delivered to him and the removal made at the risk of her owners. The last instalment of the price was paid, the ship was insured by the purchasers in their names and the certificate of the builders was handed to them, but the model, &c., were not supplied, and previous to the removal the ship was capsized by a sudden squall. On that day Captain Newell cabled to America for instructions and the next day entered his protest as to this accident, and agreed for the hire of salvage plant with the British Marine Salvage Co., Limited. Afterwards acting on legal advice he assumed the position of not having taken the delivery of the ship. The Court of Session of Scotland decided that delivery had been taken so as to transfer the risk to the purchasers, although the ship had not been moved and was not ready for sea.—*Brewer & Co. v. Duncan & Co., Limited.*

Interpretation of Lloyd's Policies as to Burning of Ship.

The plaintiffs were the owners of the s.s. *Glenlivet*, and the defendant is an underwriter at Lloyd's. An action was brought to recover the defendant's proportion of claims made by the plaintiffs on their time insurance policies on the before mentioned ship. The claims were made for damage sustained on three several and separate voyages, made when the insurances were in force. Of the two policies granted, one was dated the 26th of August, 1891, and the other on the 25th of August, 1892, and they insure the steamer for time, and have particular valuations of the hull, and materials, and machinery, and boilers, and contain the usual memorandum printed in a Lloyd's policy, which states as follows:—"Corn, fish, salt, fruit, flour, and seed are warranted free from average, unless general or the ship be stranded; sugar, tobacco, hemp, flax, hides and skins are warranted free from average under £3 per cent. unless general or the ship is stranded, sunk, or burnt." The printed clause ends with the word "stranded,"—the words "sunk or burnt" are added as is commonly done in writing. On the first voyage, on the 6th of May, 1892, it was noticed that the cross bunker was on fire, which meant that the coals in it had heated. Part of the coal was discharged, and water was pumped on the fire to extinguish it. On the 29th of the same month it was again noticed that the port bunker was on fire, and means were adopted to put it out by pumping water on it. Although there was some heating of the fuel which was extinguished by pumping water on it, there was no damage to the structure of the ship, or any part of such. On the second voyage, on the 26th of July, the starboard bunker was found to be on fire, and the crew commenced to take coal out and pumped water down to extinguish the fire, and in doing so burnt the deck hose. On the following day they noticed that a fire had broken out in the starboard bunker again, and they then began trimming the coal and pumped water down to extinguished the fire, and it was stated that on that day it was mentioned in the engineer's log book that the starboard side bunker was on fire and aflame. It further states: "Put hose in and extinguish it, working from 11 a.m. to 3.30 p.m. Bunker deck-plate slightly buckled, seams badly strained." According to the survey report after this voyage it was observed that the "second strake plate of bunker 'tween deck abaft bunker hatch was buckled downwards, the angle iron round bunker hatch buckled, the plating of bunker side and main shell plates and frames for twelve feet, with paint burnt off, coals inside bunkers required to be removed to effect the repairs, estimated about ten tons of coal destroyed. Saw some of the coal which had been fired, converted into coke.' On the fourth voyage it was noticed that the cross bunker was on fire on the 14th of October, and it was extinguished in an hour by throwing buckets of water thereon. This accident is described in the engineer's log as follows: "All hands called out to extinguish a fire in the bunker, plates buckled badly, and split." It is also stated in the surveyor's report of the damage done on this voyage that "one plate and angle bar in cross bunker (hatch bulkhead) buckled and broken, rivetting started, brick and wood casing destroyed, also fire hatches and one fore and aft donkey funnel damaged, buckled and bent." The claim on the first voyage was for a small average loss under three per cent., from other perils than fire, and on the second and fourth voyages for small average losses to the ship herself, under three per cent., partly from fire and partly from other perils insured against. It was agreed that if the ship was "burnt" on any of the before mentioned voyages, the plaintiffs were entitled to recover for a loss occurring on the voyage or voyages on which the burning occurred, and that if she was not "burnt" they are not so entitled. Mr. Justice Barnes decided that on none of the voyages was the *Glenlivet* burnt within the meaning of the policy in this case and therefore the defendant is entitled to judgment with costs, because according to the interpretation of the memorandum in Lloyd's policies, a ship is not "burnt" unless the injury caused by fire is sufficient to result in such an interruption of the voyage as to make the ship for the time incapable of being properly used for the purposes of her voyage, and that this condition may be described as "temporarily unnavigable." This learned judge added that "on the first voyage the coals heated slightly, and water being poured upon them whatever fire existed was extinguished. Even assuming that coals are to be treated as included in the word 'ship,' which the plaintiffs alleged, and the defendant did not deny, there was no interruption of the voyage, nor any interference in any way with the navigation of the vessel. On the second and fourth voyages the heating of the coal caused some damage to the structure of the vessel, but again there was no interruption of the voyage, nor any interference with the vessel's navigation." This decision has been affirmed by the Court of Appeal.—*The Glenlivet Steamship Co. v. Titcombe.*

THE FLEETS OF THE MAIL LINES.

The Biggest Cargo Steamer afloat.

In the last month's Notes something was said about the new passenger and frozen meat ship that Messrs. Ismay, Imrie & Co. had just put on their New Zealand line, and now the same firm claims attention for a new twin-screw vessel turned out, of course, from the famous Queen's Island Yard, for a very different trade. The new vessel, which is called the *Cevic*, is for the weekly direct service to New York. She sailed for her maiden trip on the 12th January. She is a craft of 5,403 tons net, and 8,315 gross register, with a load displacement of 14,089 tons, and a water ballast capacity of 1,600 tons. Captain Nicol has therefore under him a vessel that is within 70 tons as big as those famous battleships *Royal Sovereign, Royal Oak*, and *Resolution*, with their five sisters. The vessel is 500 ft. long,—equalling in this respect the Cunarders, *Umbria* and *Etruria*. But her 60 ft. of beam surpasses theirs. Her speed is 13 knots, and this is derived from two sets of triple-expansion engines whose nominal H.P. is 700 and indicated 4,000. Steam is supplied by four steel boilers whose working pressure is 175 lbs. The engines have, however, plenty of work to do besides driving the ship. Though she is "only a cattle-ship" there is a respectable installation of 300 electric lights on board. Refrigerating plant by Messrs. Hall & Co. is supplied, though of course it is not on so large a scale as that put on the *Gothic*. This ship's meat is to come over for the most part alive, and accommodation of the kind that long experience has evolved for the *Tauric* and the *Boric* is provided for no less than 800 head. Besides this the four-footed aristocracy—early and important clients of this service—have had their claims carefully considered. There are twenty stalls for them amidships where, as the old advertisement used to run, "the motion is least felt," and we may be certain that here a valuable pedigree beast or a famous racehorse will have some luxuries that were beyond the reach of the most important saloon passengers thirty years ago.

The chief difference between this vessel and her immediate predecessor, is the introduction of an extra deck. Moreover, certain additional conveniences for the crew have been made. This enlightened line has convinced itself that the way to get good men, and to keep them, is to treat them well, and the firemen on their vessels have material comforts such as lavatories and baths that would surprise old-fashioned salts.

The Old State Line.

Some little time ago the Turkish Government bought one of the State liners. It has just bought a couple more. These were the *State of Pennsylvania* and the *State of Nevada*. The price paid

for the pair, which have long been lying in the Gareloch, was £14,000. The vessels are of 2,482 tons each; so they fetched some three pounds a ton,—not at all a bad price for steamers twenty years old.

They were both built by the London & Glasgow Engineering Co., and are 330 ft. long. The *State of Nevada* has had her engines tripled in 1886 by D. & W. Henderson. The other steamer still has her original compounds.

Building Orders.

The New Year opens with an order from Cunard's to the London and Glasgow Engineering Co. above mentioned for two boats for the Boston Line. This is the first deal that has ever taken place between the two firms. The vessels are of course to be twin screws and their tonnage will be 4,820 tons each. Nine vessels will give Cunard's a weekly service to each of the two ports, Boston and New York. Including these new ones and the superannuated *Samaria* they will have a reserve of six boats for this branch of their trade. This is enough to do the whole Indian trooping business for the authorities if they were disposed to let the owners of the *Bothnia* have a monopoly. Times are too bad, however, for shipowners to sit quiet and see the plums all going in one direction.

Queenstown, *v.* Southampton.

The old-fashioned honourable rivalry between the various lines and the different ports is a thing of the past. We remember the old-time stories of the keen competition of forty years ago, and the tales of how, when competition was keenest, chivalry was uppermost in the minds of each of the rivals. In the old days when one competitor was disappointed of coal at her sailing port, the other, disdaining to take advantage of an accident, laid their own stores at disposal. Again when, through the dishonesty of a minor official, a steamer of the British Line was about to be held by the New York Custom House, it was the American Line that came forward and offered bail. As the century has progressed all "these absurd notions" are "very properly" banished, and it is appreciated that any method of striking at an opponent is fair. Strike him hard enough. Success covers everything.

The last move and its origin are, we confess, a little beyond us. The *Campania* reached Liverpool about nine o'clock on the evening of the 7th of July. It is therefore certain that many of her passengers breakfasted in London on Saturday morning. The *Paris* passed Hurst Castle inwards at 4.50 on the Saturday afternoon. She could not have disembarked her passengers before six o'clock. Our passenger *ex Campania* might therefore have left Waterloo at 3.10 p.m. (long after business houses were closed in London), and had been in the habitable part of Southampton before the *Paris's* passengers were landed. Someone writes to the *Standard* narrating this experience, and dating it from Southampton, gives a false name and address. The American Line, discovering that no one of the name lives at the address given, informs the *Standard*. And the readers of that respectable paper, seeing an apology for the insertion of the letter, believe that undue credit was given to Liverpool. No greater mistake. The facts of the letter are perfectly possible, as we have shown. They are indisputable, but this Southamptonite, by his false address has succeeded for the moment in obscuring a very decided and legitimately won triumph for the Mersey. We shall see. Tactics such as these may prolong the struggle. They cannot decide it.

The New American Liners.

From the *New York Journal of Commerce* we learnt certain further particulars of the new vessels building at Messrs. Cramp's yard in Philadelphia for the American Line. In previous issues, the progress made and the details published have been noticed. Now the names are vouched as *St. Louis*, and *St. Paul*. These ought to find great favour, for they are certainly good. They are short and distinctive. They maintain the old traditions of the Inman Line in taking the ship's names from the cities, whilst at the same time the choice is distinctively American, as it should be. The dimensions of the hulls of these vessels are given with some detail. Length over all 552 ft.; length between perpendiculars, 535 ft. 8 in.; beam, 63 ft.; depth of hold, 42 ft.; Comparing these figures with those of the *Paris*, the beam appears similar, whilst the length and depth are slightly greater, but the increase is very little. The tonnage, formerly put at 12,000 tons displacement, is now said to be 11,000 tons register. This is a considerable discrepancy. Instead of being the si[illegible]*mbria* they will be bigger than the *Paris*. Five dec[illegible]of, and this is the usual number in vessels of the class. Subdivision is said to be extensive but nothing definite is stated beyond the fact that any two compartments will be capable of being flooded without endangering the vessel's floating powers. This is considered to be the case in most recent British-built liners.

The carrying capacity is to be 1,500 tons of cargo, this presumably measurement goods. Three hundred and twenty-five saloon passengers with 172 second and 900 steerage will be the complement. Here it is noticeable that the numbers in the first cabin are not as great as those carried by the *Paris* and the *Campania*. They are almost exactly similar to the capacity of the *Teutonic*.

But whilst all details regarding these vessels, the first real Atlantic mail boats built on the other side since the Civil War, are of great importance, interest must certainly be chiefly aroused in the three vessels announced to follow quickly on the pair of sisters just referred to. It is said that as they are got out of the way the new boats will be laid down. These are to have triple screws on the principle carried out in the *Dupuy de Lome*, in the French Navy, the *Columbia* in the American Navy, and the *Kaiserin Augusta* in the German Fleet. The latter, it will be remembered, was one of the ships taking part in the great review at New York last year. We as yet have not thought a triple-screw vessel necessary either for naval or mail purposes in this country. For naval purposes much is to be said in its favour, as for cruising speeds the centre screw alone may be worked and great economy thus attained. For a mail steamer, always running at high pressure, the advantage is not so obvious. There is little doubt that three steamers beyond the *St. Louis* and *St. Paul* will be needed by the line to carry out its avowed intention of a bi-weekly service of first-class boats. But the expense of building and running will be so enormous that we may well ask how this enormous capital will be got together, at all events till American capitalists learn more accurately what are the prospects of financial success in this—to them—new field of investment.

The Gothic.

The value of the nimble ninepence is well shown by the statement now published as to the results of the exhibition of the White Star steamer *Gothic*, in the London Docks, in December. In this case it was the "gregarious shilling" that totalled up to a sum of £376. This amount was duly handed over to the committee of the Seamen's Hospital Society, and they, in recognition of the fact, have named a bed in the Royal Albert Dock Ward the "Gothic" bed, after the big ship.

Fires on Ship Board.

It is not very long ago that a serious fire occurred on board the *Ruahine*, of the New Zealand Shipping Co. Now a similar outbreak is reported on board the same line's *Kaikoura*, outward bound at Teneriffe. In both cases the fire has been subdued without any serious peril to ship or passengers. No doubt these fires have served to show in a very high degree the perfection of discipline maintained upon our mail boats and the efficiency of the modern appliances for the overcoming of conflagrations on ship board. But they are a disastrous method as far as the pockets of owners and underwriters are concerned. The vessels in this trade are all fitted with refrigerating chambers for the homeward conveyance of frozen mutton. Outward these chambers are of course, filled with general cargo, and the occurrence of a fire means considerable detention of the ship for repairs and the destruction of very expensive plant. We do not suppose there is any reason to imagine that the cause of these fires has any connection with the recent explosion on board the French s s. *Equateur*, in the Gironde, when homeward bound from Brazil. Here a package in the ship's strong room exploded with great damage to the ship and almost total destruction of the contents of the room. Unfortunately too there was no little loss of unoffending human life. This reminds us of the loss of the Ward liner a few weeks ago, between New York and Havannah. Here it has been distinctly alleged that the explosion was due to the sending of explosive parcels by persons who desired to reap insurance money for valueless goods heavily insured and forwarded by the same vessel. We do not for an instant suggest that the fires on board the New Zealand boats arose from such cause. But if such miscreants attack one branch of trade they will, if not discovered and punished, attack others. We see that our ships are able to cope with, if we may say so, "honest fires," and it behoves the authorities to see that the risk of their suffering from these most dishonest and diabolical outrages be reduced to a minimum.

The Power of the Atlantic.

Never a winter goes by without a hint from the Western Ocean that it is not yet subdued by the shipbuilders and sailors of the last part of the nineteenth century. We may improve the strength of our materials and the form of our ships; bulkheads of steel and steel decks are multiplied, yet the Atlantic can still show that it is more powerful than all. The latest great liner to be given this lesson is the fine 8,000-ton steamer *Normannia* of the Hamburg-American Line. She left New York for a Mediterranean cruise on the 18th January. This was on Thursday. Two days later she encountered a gale; but gales are to be expected at this time of year, and the Clyde-built *Normannia* made little account of it. In fact, the weather was improving, when suddenly in the darkness of Sunday morning a big sea got up on her port bow, and for a time engulfed the forepart of the ship. The details of her damage show something of the force with which she must have been struck. Public rooms destroyed, hurricane deck sprung, and the ship forced to put back to New York. Serious personal injuries to the crew were unfortunately sustained. We do not say anything of the minor injuries. The flooding of passenger space and the loss of ventilators and movables on deck is not unusual at this time of year; but the existence of tidal waves has on former occasions of this kind been disputed. Now the accounts seem to point very strongly to the occurrence of something very much out of the common. We hope that an inquiry of some scientific character may be insisted upon, and that we may hear something more definite regarding the particulars than the so-called facts contained in telegrams that have filtered through the active offices and brains of the news agencies.

THE PROPOSED FORTH AND CLYDE CANAL.

As a sequel to the opening of the Manchester Ship Canal, which we described at some length in our January issue, it may be of interest to our readers to have a plate of the route of the canal which forms the subject of this notice. At a time when so much is being said of our inadequate naval strength the project of this canal, apart from its commercial aspect, has an important bearing. With such widespread colonies, in almost every instance with a large coastline, it seems curious that the Government should remain blind so long to the advantages which a waterway through the centre of Great Britain would afford, in the way of enabling a much smaller fleet than at present is demanded, to defend the seat of Power, thereby placing a corresponding increase of power at the disposal of the Admiralty for foreign service. We have several times during the past five or six years drawn attention to this scheme, which is gradually obtaining favour, and now that the Manchester Canal is an accomplished fact and the cry for more naval power is growing stronger, we hope that the Government will at least condescend to consider this, to our thinking, feasible project, and thereby assist the promoters in coming to some conclusion as to the probable future of the scheme.

Looked at from a commercial point of view, the possibilities which crop up are much too numerous to be dealt with here, but when it is considered that the estimated cost is only £3,000,000 to £4,000,000, whilst a public company could start the Manchester Canal with an estimated cost of £6,000,000, we fail to see why this scheme has not found more favour with a nation when it has such national aspects. The annexed plan has been carefully prepared by Mr. J. Law Crawford, West Regent Street, Glasgow, the secretary to the promoters, and forms a valuable addition to his comprehensive book on the subject, to which we refer all our readers who may wish to get a thorough insight into the commercial bearings of the projected Forth and Clyde Ship Canal.

A LIVERPOOL EXHIBIT AT THE WORLD'S FAIR.

Among the many interesting maritime exhibits at the Chicago World's Fair, one which attracted more than passing notice was the collection of models of vessels belonging to the White Star Line, and specimens of their fittings and decoration.

Housed in a handsome kiosk specially erected by the Company in a conspicuous position in the grounds of the exhibition, the models were examined by numerous visitors, and proved an interesting feature of the show.

The miniature fleet represented the *Oceanic* pioneer steamer of the White Star Line, still doing her work well on the Pacific, between San Francisco, Japan, and China; the *Britannic*, for some years the swiftest vessel on the Atlantic; the various cargo steamers, and included the great 10,000 ton liners *Majestic* and *Teutonic*.

But the model of the *Britannic* and *Germanic*, although representing vessels which are eclipsed in size and speed, and the sumptuousness of their internal decoration, by the later giants, might justly claim a greater share of attention, inasmuch as these are probably the two most successful ocean passenger steamers that have ever been built, the master-pieces of the great marine architect, Sir Edward Harland.

A brass label on the show case of the model told that the *Britannic* and *Germanic* were built by Messrs. Harland & Wolff, Belfast, in 1874, their engines having been supplied by Messrs. Maudslay, Sons & Field, London, so that the vessels are now 19 years old, and it must occasion surprise to many to learn this, seeing that they are both doing their work as efficiently as ever.

The *Britannic* and *Germanic* have crossed from New York to Queenstown in 7 days, 6 hours, 52 minutes, and 7 days, 7 hours, 27 minutes respectively, and throughout their careers have shown remarkable uniformity in speed. On her 198th outward trip in September, 1893, the *Germanic* crossed from Queenstown to New York in 7 days 11 hours, next to the fastest westward run she ever made.

But the most astonishing fact remains to be stated, viz., that the *Britannic* and *Germanic* have both completed their 200th round voyage, their 400th passage across the Atlantic. This means that each steamer has traversed a distance of 200 times 6,200 nautical miles, or nearly 1½ million statute miles, with their original engines and boilers, an achievement probably without parallel in the history of steam navigation.

The following particulars concerning these vessels may be noticed. Their dimensions are:—Length, 468 ft. over all; beam, 45 ft. 2 in.; depth, 33 ft. 7 in.; gross tonnage, 5,000; I.H.P. 5,000.

The *Britannic's* records (to which the *Germanic's* closely correspond) show that she has been 91,741 hours under steam; 85,812 hours actually under weigh or moving through the water. Her engines have made 280 million revolutions, and, in maintaining an average speed of 15 knots (equal to 17¼ statute miles per hour), she has consumed 406,000 tons of coal.

The *Britannic* and *Germanic* have crossed and recrossed the Atlantic in fair weather and foul, during the 19 years of their existence, and in that time have carried 100,000 saloon and over 260,000 steerage passengers in comfort and safety between the old and the new worlds, and there must be many who have gone out from Europe in these favourite steamers 19 years ago to seek fortune in the new world, and having found it, returned years afterwards in the same vessel to visit their old homes and the scenes of their youth.

The White Star Line have recently made two important additions to their already extensive fleet. The *Gothic*, a new twin screw mail, passenger, and cargo steamer, 7,720 tons, the largest vessel with the exception of the *Great Eastern* that ever entered the Thames, sailed on her maiden voyage to New Zealand on 28th December, having previously been inspected by H.R.H. the Duchess of Albany whilst in the London Docks. The *Cevic*, 8,301 tons, a twin screw cattle and cargo steamer for the Liverpool and New York trade, arrived in the Mersey from Belfast on 7th January, and sailed on her first voyage to New York on the

12th January. This vessel, which is the largest cargo steamer in the world, makes the eighth twin screw steamer in the White Star fleet.

A satisfactory instance of the good feeling existing between seamen and their employers was shown on the last voyage of the *Doric*, of the same company's fleet, when, on returning to London from New Zealand, the captain was able to report that there had been no change in his crew on the voyage round the world, and that all deserved their V.G. characters.

H.M.S. "EMPRESS OF INDIA."

OUR double-page plate illustration for this month is H.M.S. *Empress of India*, one of the eight first-class armoured battleships of the *Royal Sovereign* type, built under the Naval Defence Act of 1889.

This vessel, originally laid down at Pembroke Dockyard as the *Renown*, was re-christened *Empress of India* by the Duchess of Connaught, when she was launched in May, 1891. As soon as she was afloat, the steam machinery was placed on board by the contractors, Messrs. Humphreys, Tennant & Co., and after some further work had been done on board, the vessel was in February, 1892, sent round to Chatham to receive her guns and to complete for sea in all respects. She is said to be the most cheaply constructed of her class, having cost only £920,000, or about £20,000 less than the *Royal Sovereign*. She made her trials in May, 1893, and was ready for service by August, but was not commissioned until September 11th, when she hoisted the flag of Rear-Admiral E. H. Seymour, C.B., to take the place of H.M.S. *Anson* as second flagship of the Channel squadron. She is therefore classed as a West County ship, with her headquarters at Devonport, and before leaving England she was for some little time in the hands of the engineering department at Keyham.

The dimensions and characteristics of the *Empress of India* are as follows:—Length, 380 ft.; breadth, 75 ft.; mean draught of water, 27 ft. 6 in.; displacement, 14,150 tons; freeboard forward, 19 ft. 6 in.; freeboard aft, 18 ft. She is constructed entirely of steel, and above the double bottom, which extends under the greater portion of the vessel, may be said to be divided into three large compartments; each of these being again considerably subdivided, there being altogether upwards of two hundred watertight compartments. In the centre division on the inner bottom are two sets of engines and boilers, separated by two longitudinal bulkheads, between which are the principal magazines, with a passage connecting the fore and aft divisions, running on top of them. On the outside of the boilers and machinery other longitudinal bulkheads form with the outside of the ship, coal bunkers and wing spaces. Forward and aft of the athwartship bulkheads, which close in the boilers and machinery, are the auxiliary steam engines for steering and other purposes, the electric and hydraulic engines, workshops, and storerooms. When the ship is at her proper load draught, the waterline is nearly level with the top of the passage before mentioned. Above this are two decks known as "belt" and "main," and here the officers and crew are accommodated. The upper deck extends the whole length of the ship, with a protected superstructure amidships carrying shelter decks, conning towers and flying bridges.

Armoured protection is give to the ship by a steel deck 2½ in. in thickness at the extremities of the vessel, and 3 in. thick in the centre. This deck for a distance of about 70 ft. from bow and stern is under water, and then rises to about 3 ft. above the normal water line. Here it is horizontal amidships and for the greater part of the width of the vessel, but sloping at the sides. On top of this deck is a belt of steel from 18 in. to 14 in. in thickness, and 8 ft. 6 in. deep, extending over 250 ft. of the midship section of the 380 ft. length of the vessel. This belt protects the belt deck and waterline. Above it over 144 ft. of the midship section is a lighter strip of steel 4 in. thick, giving protection to the main deck. At either end of this strip are athwartship screens, 3 in. thick, closing in the secondary battery. Some further protection is given by the arrangement of the coal bunkers. The fore conning tower is protected with 14 in., and that aft with 13 in., steel armour.

The principal armament consists of four 67-ton, 13½ in. guns, placed in barbette towers at either end of the superstructure, and just outside the screens. The tops of the barbette projects a few feet through the upper deck, and the controlling and actuating machinery for gun and towers is hydraulic. The secondary battery consists, on the main deck, of four 6-in. 100 pr. q.f. guns, placed inside casemates, and twelve 6 pr. q.f. guns; on the upper deck, six 6-in. 100 pr. q.f. guns, and four 6 pr. q.f. guns; there are also nine 3 pr. q.f. guns, two 9 pr. l.m. guns for field purposes, eight machine guns, and seven torpedo tubes, two of which are submerged. The two steel masts are fitted with fighting tops, carring light q.f. and machine guns. The weight of the armament is nearly 2,000 tons.

The vessel is fitted with two three-bladed propellers, each driven by a set of triple-expansion engines of the three-cylinder type, steam for which is supplied by four single-ended boilers. She passed through her steam trials most satisfactorily, that with natural draught on May 4, 1893, when on a seven hours run a power of 9,507 horses was attained, or 507 more than was called for by the contract. The forced draught trial took place on May 6, when 11,625 I.H.P. was developed, which is also in excess of contract stipulations, and a speed of 18 knots per hour. The air pressure used was 1 in., and there is no question that if necessary the engines could have been worked up to 12,000 H.P. At designed load-draught, the ship carries 900 tons of coal, giving her a radius of action at 10 knots of 5,000 knots, but arrangements are made so that in case of necessity 400 more tons can be stored on board. The auxiliary engines for steering, electric lighting, air compressing, evaporating, boat-hoisting, and other purposes, are 69 in number, the electric installation including 700 glow lamps, and four search lights of 25,000 candle power. The ship's complement is 702 officers and men.

On her first cruise the *Empress of India* developed an extraordinary capacity for rolling, a defect shared by all her sisters. This is not to be taken as a sign of instability, but rather the reverse. It is, however, a cause of much discomfort to her crew, and would be dangerous if any of her heavy weights were insecurely fastened. Probably the provision of bilge keels will lessen this tendency to heavy rolling, but it must be feared at some loss of speed.

LEVEN SHIPYARD AWARDS' SCHEME.

THE 14th annual report of the above Committee has been issued. During the year 57 new claims have been considered, and of this number 38 have been successful, 15 rejected and four postponed. The total sum expended during the year was £144, of this sum £96 was paid in ordinary awards and £48 in premiums.

At the beginning of last year the firm issued a circular to the employés, pointing out the benefits to be attained through participation in the objects of the scheme, and expressing the hope that an improvement in the results would take place during 1893. The Committee now congratulate the workmen on the hearty response made to this appeal, and have pleasure in stating that the number of claims received, the number of awards made, and the amount of money expended, are not only much greater than those of last year, but are the third highest produced by the scheme, and that fully 66 per cent. of the total number of claims received were successful, as against an average of 52 per cent. for the 14 years the scheme has been in operation, and the workmen in the iron department have this year succeeded, for the first time, in sending in more claims than those of any other department, while the electrical department have been successful above all others, considering the number of workmen connected with the branch.

Since the introduction of the scheme, 602 claims have been received, 313 being successful, and 289 rejected. The total sum expended is £1,480, of which £1,034 was paid in awards and £446 paid in premiums.

The sum of £908 has been gained by 18 claimants in the following sums respectively:—

£96, £77, £75, £63, £62, £59, £56, £42, £41, £39, £39, £38, £36, £34, £34, £32, £24.

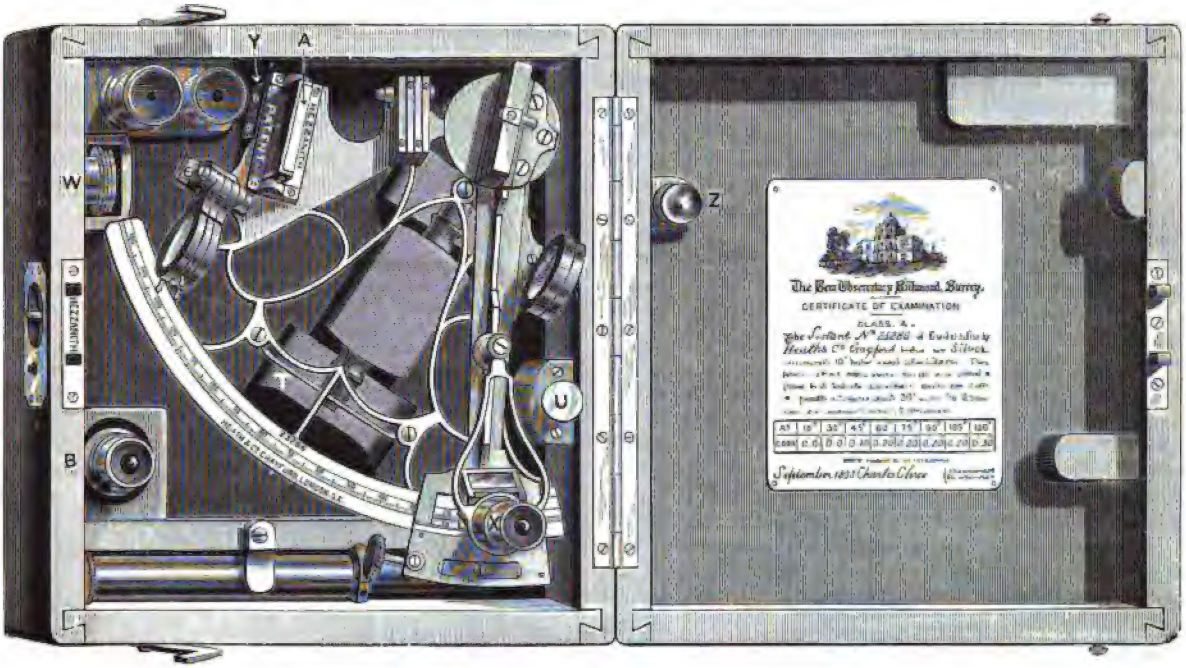
While Messrs. Denny & Bros. deserve much credit for initiating such a praiseworthy scheme, the workmen have to be congratulated for the interest they have manifested in the same.

The Glasgow University Engineering Society held its fifth ordinary meeting on Tuesday night, January 16th, Professor Biles, M.C.I.N.A., presiding. The chairman opened an interesting discussion on the Relative Merits of Keel and Centreboard Yachts. At the close of the meeting a number of slides illustrative of every class of yachts were, through the kindness of Messrs. Adamson, photographers, Rothesay, and Mr. Wilfred Hunt, shown on the screen.

THE "HEZZANITH" SEXTANT.

ALTHOUGH such great strides have been made in improving all kinds of scientific instruments within the last few years, the sextant seems to have remained stationary for the past quarter of a century. However, Messrs. Heath & Co., Limited, of London and Crayford, have just brought out a new pattern of sextant, which has been designed to meet the requirements of the latest "Extract from Admiralty Regulations, respecting cadets whilst under training." We understand its general manufacture, quality of glasses, and accuracy of graduation are such as to have passed the Kew Observatory test with a class A certificate.

The new patent sextant has, what is termed, an "Hezzanith" adjustment to the horizon glass which has the following advantages :—



Both the vertical and horizontal adjustments of the glass are effected by a movement of the entire frame and glass (marked "Hezzanith Patent" in the picture), instead of the glass only within its frame, as in the ordinary method, and only obtained by the varying pressure of screws and springs upon the glass itself, causing generally a warped glass and blurred, untrue image.

As the glass is fixed in its frame, it is possible to fill in, and hermetically seal the silvered part. This preserves the mirror from the corroding effects of exposure to damp and salt water.

The upper or unsilvered part of the horizon glass (A) is preferentially entirely dispensed with, and also its framing, so that a clear unimpeded view may be obtained when using the large object glass Star Telescope (B). In the act of cleaning the upper portion of the old-fashioned horizon glasses, the edge of the silver is often damaged and considerable trouble caused thereby. It is evident that such an accident cannot occur with the "cut off" horizon glass.

The horizon is made nearly double the usual width, to take in all the field of the Star Telescope (B) as well as having other obvious advantages.

There are no caps or other loose parts to be lost, all the adjustments being made with a key (Z) which screws into the case, and adjusting screws (V) being so inlaid that caps are unnecessary.

The adjusting screws (V) are close together, and so act that the oblique motion common to most adjustments is avoided, each screw moving the horizon glass at right angles to the other. This advantage is unattained by the usual "Fixed" mode; and is one which simplifies the adjustment of the Sextant considerably.

The magnifying glass (X) for reading off the arc and vernier is made to oscillate, so that the observer may change its angle to suit the light, or to set the glass central with any part of the dividing, that the objectional parallax is avoided.

A special form of compound eye head (W) for the telescopes can be used. It consists of a disc which easily screws or slides on all the telescopes, and has an internal revolving plate with projecting milled edge. In this plate are four openings, numbered; three of them being glazed with varying neutral tint shades. The advantages of this form of eye head are many. For instance, should the light of the sun vary during the observations, by a slight touch of the finger a lighter or darker tint of glass may be placed over the telescope. The use of this dark glass compound eye head is advised when possible, as owing to its position on the instrument, any defect in the glasses are not magnified, as would be the case in the use of the index and horizon glass shades, which are upon the limb of the Sextant, and thus in front of the telescope.

It is usual to hold Sextants in their mahogany cases by means of packings fixed in the lid, and pressing upon different parts of the instrument; and by holding down buttons clamping upon the handle. Both of these methods are dangerous. The packings in the lid of the case are liable to bend the instrument, and the handle buttons easily get out of order, and are troublesome both in fixing and releasing the instrument. In this Sextant all these difficulties are avoided, for by means of a simple spring and catch, under the handle, on placing the Sextant in its case, it is automatically and fixedly held in position, the release being effected by pressing a button (U) or other similar method fixed on the case with the right hand, whilst with the left hand the instrument is lifted out of the case. It often happens that by omitting to close the lid securely, the instrument is thrown out of its case, and more or less damaged. With this patent no such accident could possibly occur.

To furthur secure the instrument against accident, the lid of the case is automatically fixed by a patented spring catch (V), as soon as it is pressed down to the closed position. The usual hooks and lock are provided as further security, but this automatic spring fixing is sufficient should the others by any accident or urgency be omitted. Many other detail improvements have been made (including the special form of "Bridge Handle" (T) by which the instrument is held by three arms instead of two).

LIST OF VESSELS LAUNCHED IN 1893.

AMERICAN.

By Globe Iron Works Co., Cleveland, Ohio.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
* Vega	Steel	Steam	Ameron.	2,143	600
By Cleveland Shipbuilding Co., Cleveland, Ohio.					
† Yuma	Steel	Steam	Ameron.	2,194	1,130
† Alva	"	"	"	2,419	1,544

NORWEGIAN.

By Laxwaags Shipbuilding and Engineering Co., Bergen.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Ornen	Steel	Steam	—	100	20
* Argus	"	"	—	69	30

* Compound. † Triple.

The above arrived too late for publication in our January number.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our own Correspondent.)

The New Naval Programme.

Up to the present time, although there have been many rumours in the newspapers, nothing certain has transpired with respect to the expected naval programme. Many of the rumours have emanated from dockyard sources, and being based on the draught schemes submitted for consideration to the Admiralty are for the most part purely imaginary. It is probable that others are in the nature of kites flown by the Government for the purpose of learning the strength of the national feeling on the subject. In these circumstances it would be a waste of labour to criticise them, especially as nothing has yet transpired to show that they are likely to be adequate or sufficient to allay public apprehension. It is probable that a great deal will depend upon whether the Ministry consider that the time has come for another general election. In that case it may be expected that the programme will be small and of a temporary character with consequent loss of much sorely wanted time. On the other hand, if the elections are likely to be postponed until the end of the year, then a programme which might be held a concession to public opinion might be forthcoming with a view to results at the polls. In any case the Government will have to reckon with the extreme Radicals, who are by no means disposed to see the necessity for a large expenditure in the direction of maintaining that Naval supremacy which is essential to the well-being of the Empire and its interests.

A Novel Proposal.

"Civis," a correspondent of the *Times*, projects a novel departure in connection with our Naval needs. Premising with a reference to the Naval scares of 1884, 1888 and 1893, as tending to show that Ministries of whatever party politics are unable to combat successfully the parsimonious notions of the Treasury and the expedient views of Chancellors of the Exchequer, without strong outside agitation, this writer proposes the formation of a "National Navy League," having for its objects the education of the British public and the keeping the Government of the day up to the scratch. In this way he believes that the force of public opinion would compel a reluctant and hesitating Government to embark in the additional and necessary shipbuilding. Two objections have been made to the scheme, and two only. One, that by the institution of such a League the Cabinet would feel relieved of a certain amount of responsibility; and the other that it might fall into the hands of a party and make the question of national defence assume a political aspect. These objections, however, might be removed if the programme of the League were strictly defined and adhered to. There can be no question that some steps must be taken in this

direction and there are men of all parties who feel this necessity; it is however, as yet too early to say how the proposal will be received and what will come of it. Meanwhile the fact that such a proposal has been made is significant of the way in which men's minds are tending.

Portsmouth Dockyard.

The new year has opened auspiciously and with the promise of plenty of work. The rumour is that instead of one *Majestic* we are to have three built here, and although the rumour does not gain much credence, it is felt that very probably there is some foundation for it and that possibly two of these big battleships will be constructed in the yard. As yet the *Majestic* has not been laid down in No. 13 dock, where she is to be built, but the preparations are very forward, and when she is begun will expedite matters considerably. The *St. George*, of the Defence programme, has arrived from Hull; coming round her engines worked very smoothly, and subsequent trial has shown them to realize more than the contract power. The *Centurion* has made successful gun trials and will soon be ready for China; it is expected that she will be commissioned almost immediately. The building of the *Eclipse* makes good progress, and so does the rebuilding of the *Sultan*. We have also had the *Victoria and Albert* and the *Osborne* in hand here, the former vessel is making a trip to bring the Empress Frederic over, and the Prince of Wales requires the latter for a cruise up the Straits. The torpedo-boat destroyer *Havock* has been sent here as a tender to the *Excellent*, and as soon as fine weather sets in will make some trial trips in the Channel. The *Neptune*, *Howe*, *Swiftsure* and *Resolution* have been added to the ships having their head-quarters here, and new crews for the *Marathon*, *Lapwing*, and *Ringdove* have been despatched from this port. The crew of the *Mohawk* from the West Indies were also paid off here in January.

The "Powerful" and "Terrible."

Both of these huge cruisers are to be built by contract, the *Powerful* by the Naval Construction and Armaments Co., at Barrow, and the *Terrible* by Messrs. J. & G. Thomson, of Clydebank. The price to be paid for the hull of the former is £338,000, and for that of the latter £345,000. The principal machinery will cost about £100,000. The adoption of the Belleville tubulous boilers for these vessels is a great experiment which will be watched very anxiously by engineers, especially as the power to be developed is 25,000 horses, which it is anticipated will give a speed of 23 knots an hour. This a higher power than has yet been demanded from this type of boiler, although vessels in the French Mercantile Marine have been fitted with it, and realize as much as 10,000 horse power. So far the *Speedy* is the only vessel in the British Navy to be so fitted, and the type used in her and patented by Messrs. Thornycroft is said to be unsuitable for very large vessels. Messrs. Yarrow have also a patented design for small craft, which will soon be tried in the *Hornet* torpedo-boat destroyer, which vessel is expected to obtain a speed of over 27 knots. All these trials should afford very interesting and useful data, and those of the *Sharpshooter* will doubtless be pressed on before a final decision is arrived at as to more extended introduction of the system. The paper read by Mr. J. T. Milton at Cardiff contains pretty nearly all the information at present obtainable on the subject of water-tube boilers as applied to marine purposes.

Devonport and Keyham Dockyards.

Work is proceeding here briskly, and the promise of next year's programme is fairly satisfactory. More gunboats, and perhaps one big cruiser appears to be about the bill. Two ships were commissioned here on January 16th, and both for the Mediterranean Station, they are the *Æolus* and the *Spartan*, and on board them Captains A. L. Winslow and R. L. Groome, hoisted their respective pennants. They had already been commissioned for manœuvres, but have since been supplied with several quick-firing guns in place of ordinary breechloaders of the same calibre. They will form a useful accession of strength to Sir Michael Seymour's squadron. The *Harrier*, gunboat, is to be launched February 20th, and then we shall be able to make a start with the *Talbot*. The *Northumberland* refitting here, it is now said to go to Esquimalt as port guard ship, was to have been ready for her trial by March, but she has been put on one side owing to the necessity for putting hands on the *Undaunted*, which vessel is to be brought forward for commission on the China Station. The *Colossus* and *Devastation* have been made West country ships as well as the *Empress of India*, which vessel, like her sister, the *Resolution*, has been in the Keyham for repairs. The *Antelope's* trials have proved a success, although the eight hours run was on the first occasion stopped by a split feed-pipe. The *Sharpshooter*, fitted with the Belleville type of tubulous boilers, will soon be ready for trials, and these are anxiously awaited, for by their results may hang the ultimate decision whether other gunboats and crusiers shall have this kind of boiler. Another set of tubulous boilers, the Du Temple type, are coming over to be tested in the *Spanker*, but they are not due to arrive now until April or May.

The Torpedo Boat Destroyers.

Orders for thirty-five out of the forty-two vessels of this type have already been distributed by the Admiralty to the following firms. Messrs. Thornycroft & Co., Chiswick (5), *Ardent*, *Boxer*, *Bruiser*, *Daring* and *Decoy*. Messrs. Yarrow & Co., Poplar (5), *Havock*, *Hasty*, *Hornet*, *Charger* and *Dasher*. Messrs. Laird, of Birkenhead (4), *Ferret*, *Lynx*, and two unnamed. Messrs. White, of Cowes (3), *Conflict*, *Teazer* and *Wizard*. Messrs. Palmer, of Jarrow (3), *Janus*, *Lightning* and *Porcupine*. Messrs. J. & G. Thomson, of Clydebank (3), *Rocket*, *Shark* and *Surly*. The Naval Construction and Armaments Co., of Barrow (3), *Starfish*, *Sturgeon*, and *Skate*. Messrs. Doxford, of Sunderland (2), *Hardy* and *Haughty*. Messrs. Earle, of Hull (2), not yet named. Messrs. Hanna, Donald & Wilson, of Paisley (2), *Fervent* and *Zephyr*. Messrs. Hawthorn, Leslie & Co., Newcastle (2), not yet named. The Elswick Co. (1), not yet named. It is expected that early in the spring the Yarrow boat *Havock* will be sent for an experimental cruise to Gibraltar, as although the speed obtained at her trials was highly satisfactory, and her handiness, owing to the special steering gear fitted by Messrs. Davis & Co., left nothing to wish for in this direction, it is felt to be highly desirable that her seaworthiness should be tested under such conditions as will leave no doubt on the matter. The Yarrow boat *Hornet*, fitted with tubulous boilers, will soon be ready for trial, and will be followed by the Thornycroft boat *Daring*, and the Laird boat *Ferret*. Capability to keep the seas in rough weather, high speed, and good manœuvring powers are the three essential qualities in these destroyers, and the constructors of the boats and makers of their steering gear having fully coped with all demands in the two last named respects, a run across the Bay would show whether the third has been equally well supplied.

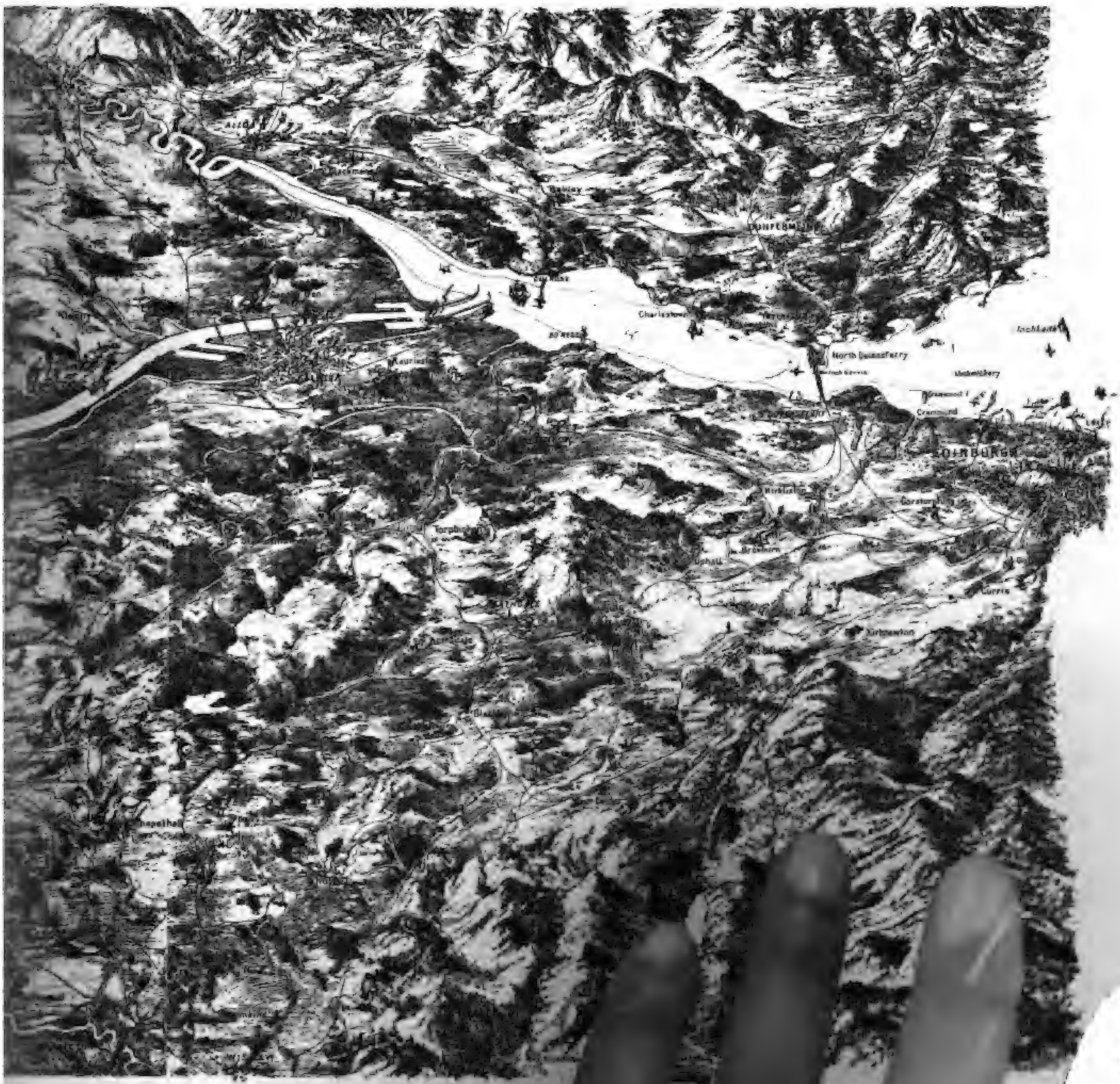
Chatham Dockyard.

According to report, based on the sketch proposal sent here from the Admiralty, another battleship of the *Magnificent* class is to be commenced this year. The keel plates of the *Magnificent* herself were laid here on December 19th, and work on her is making a good show. She will be the largest vessel yet built in this yard, but we shall be glad to have another in hand. Meantime, other vessels are making rapid progress. The *Grafton*, from the Thames Iron Work Co., has been completed at a cost of £373,000. The *Barfleur* is to be ready for the pennant by March 31st. The *Forte* and *Dryad* are being hurried on, the latter vessel having already got her machinery and boilers on board. The trials of the *Theseus*, at first unsuccessful owing to some trouble with the filter attached to the feed pumps, have since been most satisfactory. The *Satellite* was commissioned by Commander A. G. Allen on January 9th, to relieve the *Garnet* on the Pacific station, with a crew of 166 officers and men. The *Landrail* is also in hand, the *Agincourt*, which has been reboilered and partly re-armed, will very shortly be ready for her trials. This vessel, it is now reported, and not the *Ajax*, will go to Hong Kong as port guardship. The *Niger*, gunboat, commissioned here January 26th, to take the place of the *Firm*, as tender to the *Galatea* at Queensferry, and the *Skipjack*, gunboat (91), for service in the Mediterranean. The *Monarch*, another vessel in construction here, is being supplied with new engines by Messrs. Maudslay, Sons & Field. The *Rambler*, which had been brought forward for the surveying service, has been put back to allow more progress on the *Hearty*. There are to be further trials with Martin's induced draught on board the *Gossamer*.

The Trooping Service.

A question that will soon bring itself into prominence is that of the future policy in regard to the Indian trooping service. Those erstwhile magnificent vessels, the *Serapis* and her sisters, are nearly played out, and while they would probably make

THE PROPOSED FORTH



DE CANAL. (*See page* 469.)

efficient depôts for training boys, they are no longer fit for the purpose for which they were built. The *Malabar* has recently illustrated this fact most fully. She was on her outward voyage when the crank shaft gave out, and she had to go into Malta to be fitted with a spare one. Then when she went out for trials the cranks were found to be out of line, and the shafting untrue, which necessitated further delay, and altogether about a fortnight was lost. Then when about 70 miles out of Aden, a steam pipe burst, and having to confine herself to the speed of seven knots, she was four days longer than usual in reaching Bombay. The *Crocodile*, also, on her last homeward voyage had what was nearly a very serious disaster off Aden. The crosshead of the piston of the high-pressure cylinder suddenly broke, with the result that the piston forced its way through the cylinder, and but for the admirable conduct of the engineers, great danger to the machinery and perhaps loss of life would have followed. After temporary repair had been effected she made her way to Malta at 7 knots speed, and there being patched up, managed to come home at the rate of 8½ knots an hour. This is not the way to send troops about, and it is strenuously urged that a much more efficient and economical system of conveying reinforcements to India and bringing back time-expired regiments would be to utilise our vast resources in the Mercantile Marine. Naval officers and men would be glad to be rid of the business, and they would be all the better employed in their legitimate work of handling regular sea-going men-of-war.

Automatic Watertight Doors.

An important invention, which will enable battleships to keep afloat after serious injury, has been made, says the naval correspondent of the *Westminster Gazette*, by two shipwrights employed at Devonport Dockyard, who have devised an ingenious arrangement for closing the watertight doors automatically. By this arrangement, when a ship has been torpedoed or rammed, the water as it rushes into the compartment will first ring a bell to warn any persons in the neighbourhood of their danger, and then, on reaching a certain height, will cause the watertight doors to close without any manual assistance. The invention has been brought under the notice of the Admiralty. and their lordships have been so favourably impressed that they have asked to be supplied with further particulars.

Sheerness Dockyard.

The two station gunboats, *Torch* and *Alert*, have already been described in this column; work is now progressing very fast upon them, and it is confidently anticipated that they will be ready by 1895 as arranged for. In one of the rumoured programmes which have been put forward recently it was stated that some sisters to the *Torch* and *Alert* will be laid down at Devonport this year. There may be some truth in this, but the further statement of the writer that these ships are known as the *Linnet* class is absurd, the *Linnet* being a very different vessel. In any case this class of ship is built for police, not for war purposes, and adds nothing materially to the strength of the Navy. The capital passage of the *Gleaner* gunboat across the bay, when the *Resolution* had to turn back, pleased everyone here, where she was built and engined; she is to relieve the *Sandfly* which, however, will be kept in reserve at Malta. Of the other gunboats here, the *Renard* has been transferred to the Medway fleet reserve, the *Hebe* is ready, and the *Leda* nearly so. The *Speedy* will probably be passed into the reserve about February 16th. The *Havock* after her trials left here for Portsmouth, but two more torpedo boat destroyers are expected from the shipbuilders on the Thames during the ensuing month. The *Dreadnought*, *Revenge*, and *Edinburgh* have been transferred to the reserve here, the last named having arrived from the Mediterranean, has paid off, and the crew of the *Audacious* being turned over to her, she is now to be the guardship at Hull.

Warship Machinery Construction.

A considerable increase is noted, says the *Globe* naval correspondent, in the power of engines completed on the Thames for warships during the past year. The aggregate of 185,000 I.H.P. is considerably greater than in previous years. Messrs. Humphrys, Tennant & Co. head the list with the machinery of the battleships *Empress of India*, *Hood*, and *Repulse*, and the first-class cruiser *Grafton*—all these ships having twin-screw vertical triple-expansion engines of 13,000 H.P. under forced draught. They have also completed and tried the engines of 16,000 H.P., in the Japanese cruiser *Yoshino*, and engines of 14,500 H.P. in the Argentine cruiser 9 *de Julio*. They have delivered engines of 10,600 H.P. for the Russian armourclad *Tri Sviatitelia*, and they have in course of construction engines of 10,600, 14,500, and 17,000 H.P., besides work of less importance. Messrs. Maudslay, Sons & Field completed the engines of the two British cruisers *Theseus* and *St. George*, each of 13,000 H.P., and engines of 3,500 H.P. for the first-class gunboat *Dryad*, while for foreign Powers the engines of the *Re Umberto*, 19,500 H.P., and the *Admiral Ovshakoff*, 5,000 H.P., have been completed, as well as machinery of 6,000 H.P. for the battleship *Devastation*. Messrs. John Penn & Sons, Greenwich, have finished the machinery for the *Crescent*, British cruiser of 12,000 H.P., and for the torpedo gunboats *Circe*, *Leda* and *Alarm*.

Pembroke Dockyard.

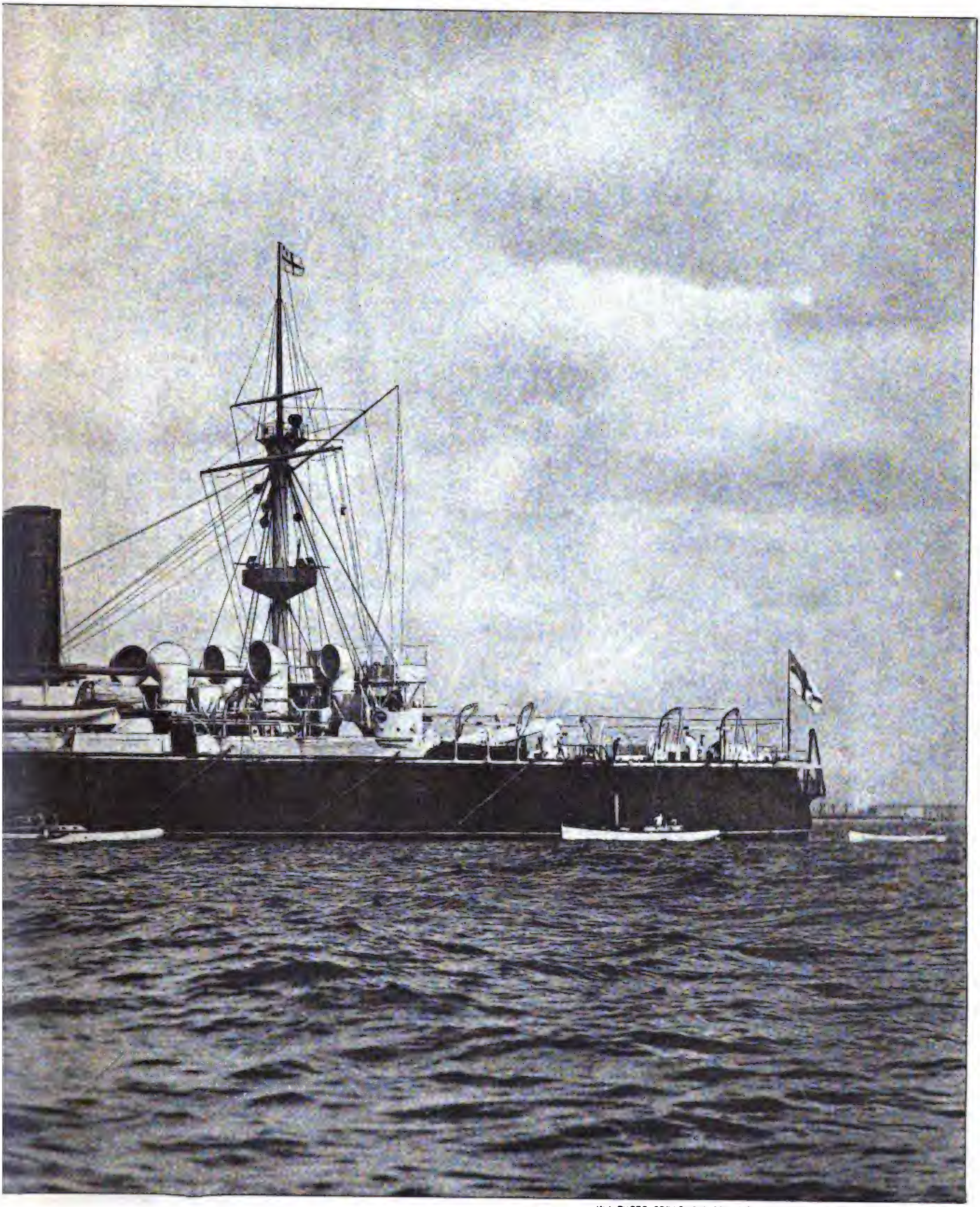
The publication of the new programme is awaited with some anxiety at this yard owing to recent reductions. The *Renown*, laid down January 1st, 1893, is now ready for her armour, and it would be economical to begin another ship of the same class here. Two of the biggest ships of the Naval Defence Act were built at Pembroke, the *Empress of India* and *Repulse*, it is therefore expected that the construction of another battleship will not be long delayed. We have lost the *Cambrian*, and a very nasty voyage she had round to Devonport. Soon after leaving here the eccentric of the starboard high-pressure cylinder gave out, and the vessel had to run with her port engines alone for a time. It was blowing at the time, and this made the position disagreeable. However, the engine-room staff went to work and cut off the connection between the starboard engines and the high-pressure cylinder, and then got them to work. The smartness and resource of the engineer in charge and his assistants is highly creditable. The *Hazard*, gunboat, which has already her propelling machinery on board, will be launched February 16th, and then taken to Devonport to be fitted for service. A letter from Malta received here states that the *Sanspareil* is having six extra watertight bulkheads fitted on the main deck for the purpose of restoring confidence among her ship's company. That there should be any real need for this additional subdivision would seem to argue that the constructors are not altogether satisfied about the *Victoria*. In the same letter it is said that the *Polyphemus* is in dock and having new tube plates fitted to her condensers, besides other repairs. It is often asked why the *Polyphemus* has never been duplicated, but seeing that her first cost to date of completion in 1882 was £225,000, and that since then her repairs have come to upwards of £65,000, it is not perhaps to be wondered at the Admiralty prefer to do without another such extravagant item.

Mechanical Stoking.

The *Army and Navy Gazette* understands that a system of mechanical stoking has been introduced into certain vessels of the French Navy with a very fair promise of success. This arrangement, if ultimately found to answer, will be a modification of no small importance. It appears that any satisfactory solution of the question of stoking mechanically would be hailed with pleasure by our naval engineers, and if it is found to be a success in France it should be adopted in our fleet without delay. The ordinary mechanical stoker which is applied to shore boilers would not, of course, act well at sea when the ship was unsteady. The fire bars, which receive the coal from the hoppers and carry it forward into the furnaces, afterwards sinking and retiring with the motion of the machinery, are smooth, and the coal would be rolled about on them by the motion of the ship. We doubt, also, whether they have substance enough for the intense heat which is developed by forced draught. But these difficulties might, we think, be surmounted by strengthening the bars and making projections upon the upper surface, which would retain the coal in its place. The advantage which would be gained by sealing up the stokeholds and leaving the diabolical process of stoking, in such circumstances, to be done automatically, cannot be overestimated. The miseries that the stokers undergo whilst forced draught trials are being carried out have to be seen to be realized.

Steam Cable Gear.—The Lords Commissioners of the Admiralty have decided to adopt the designs of, and have placed the contract with Messrs. Baxters, Limited, engineers, of Sandeacre, Nottingham, for the steam cable gear required for the new cruisers, H.M. ships *Talbot*, *Minerva*, and *Eclipse*, recently laid down at Devonport, Chatham, and Portsmouth, respectively.

H.M.S. "EMPR



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SS OF INDIA."

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from December 19th, 1893, to January 24th, 1894:—

Allen, Joseph W., staff engineer to the *Excellent*, additional, to date January 2nd.

Austen, Edwin J., chief engineer to the *Excellent*, additional, to date January 2nd.

Baker, Frederick, assistant engineer to the *Spartan*, to date January 16th.

Block, Robert J., assistant engineer to the *Centurion*, to date January 11th.

Bolt, Charles W., engineer to the *Vivid*, supernumerary, to date January 11th.

Bromley, William, chief engineer to the *Excellent*, additional, to date January 2nd.

Chope, William D., engineer to the *Sturgeon*, to date January 23rd.

Cornish, Edwin, chief engineer to the *Excellent*, additional, to date January 2nd.

Davies, William A. J., engineer to the *Hibernia*, additional, to date January 20th.

Edwards, Robert W., staff engineer to the *Boadicea*, to date January 20th.

Ellis, Ernest F., chief engineer to the *Cossack*, to date December 27th.

Ellis, M. W., staff engineer to the *Excellent*, additional, to date January 2nd.

Ford, Francis, fleet engineer to the *Audacious*, undated.

Garwood, H. T., engineer to the *Audacious*, undated.

Gorfett, George J., chief engineer to the *Gossamer*, to date January 16th.

Griffin, Daniel, chief engineer to the *Excellent*, additional, to date January 2nd.

Gulliver, William H., fleet engineer to the *Amphion*, to date January 5th.

Haddock, Sidney G., engineer to the *Satellite*, to date January 9th.

Hart, Alfred, engineer to the *Sandfly*, to date January 20th.

Highton, Francis W., engineer to the *Alarm*, to date January 16th.

Hinchcliffe, William F., engineer to the *Vivid*, additional, to date January 16th.

Hyde, Thomas H., staff engineer to the *Edinburgh*, undated.

James, Charles J., engineer to the *Havock*, undated.

Johnson, John E., chief engineer to the *Tribune*, to date January 16th.

Jose, F. W. R., engineer to the *Vivid*, supernumerary, to date January 3rd.

Jose, Francis J. R., engineer to the *Defiance*, to date January 20th.

Kerr, Alexander, chief engineer to the *Calliope*, to date December 27th.

Madge, Henry A., engineer to the *Hearty*, additional, to date January 16th.

Matthews, William H., staff engineer to the *Excellent*, additional, to date January 2nd.

Mitchell, William H., staff engineer to the *Œlus*, to date January 16th.

Paterson, George T., assistant engineer to the *Revenge*, to date January 11th.

Pedrick, John R. J., chief engineer to the *Forth*, to date January 5th.

Pibworth, William H., staff engineer to the *Excellent*, additional, to date January 2nd.

Pitt, John, fleet engineer to the *Excellent*, additional, to date January 2nd.

Rundle, Mark, assistant engineer to the *Bonaventure*, to date January 11th.

Sharp, William, staff engineer to the *Spartan*, to date January 16th.

Silk, Ethelbert S., engineer to the *Skipjack*, to date January 16th.

Stone, Alfred T. H., engineer to the *Spartan*, to date January 16th.

Stone, Alfred T. H., engineer to the *Vivid*, additional, to date January 1st.

Thompson, Geo. F., assistant engineer to the *Edinburgh*, to date January 24th.

Tilbrook, Charles F. H., engineer to the *Skipjack*, to date January 16th.

Walker, James J., staff engineer to the *Excellent*, additional, to date January 2nd.

Wand, Edward V. (probationary), assistant engineer to the *Revenge*, to date January 11th.

Westell, Edwin R., assistant engineer to the *Aeolus*, to date January 16th.

Yaroe, Robert B., engineer to the *Aeolus*, to date January 16th.

HOAR & BROWN'S ANNUAL HARDWOOD MARKET REPORT.

Teak.	Timber.	Planks.
Stock, 31st Dec., 1891.	7,020 loads	2,562 loads
" " " 1892.	4,824 "	2,274 "
" " " 1893.	4,719 "	2,449 "

The imports of both timber and planks have greatly exceeded those of last year, but the deliveries also reached larger figures, making the present stock of 7,168 loads about equivalent to that at the end of 1892, but it will be noticed there is a considerable falling off as compared with the figures recorded at the end of 1891, viz., 9,582 loads.

Cargoes afloat, destined for various ports, amount to 11,000 tons, besides 25,000 tons engaged by charter to load. This is a far larger quantity than was on record this time last year, but prospective requirements, including the Admiralty orders amounting to 9,000 loads, will more than counterbalance what would otherwise be considered a disquieting feature in the outlook.

The continued depression in the shipbuilding, railway carriage and allied trades has kept the demand very quiet, and by degrees reduced prices to the abnormally low point at which they have stood for some time, but values are now understood to be advancing at ports of shipment. Steamer freights have remained very depressed throughout the year, and consignments were in consequence pushed forward, resulting in extremely low quotations, and no substantial improvement is therefore expected until the cheap importations resulting therefrom are cleared off.

Notwithstanding the depression referred to, the average consumption for the past few years has been exceeded by about 3,000 loads showing that the low prices which have prevailed have been the cause of finding fresh uses for the wood. There can be no doubt that the consumption of teak would be considerably increased if a steadier market could be maintained at about present values. With regard to planks, the stock now stands at 2,449 loads, which is slightly more than in 1892, and about equal to 1891. During these periods, prices have been declining gradually, and are not likely to turn until the present excessive stocks are decreased by one half.

Mahogany.—

The stock on Dec. 31st,	1893,	was	6,100,000 feet.
" "	1892,	"	4,300,000 "
" "	1891,	"	3,500,000 "
" "	1890,	"	2,100,000 "
" "	1889,	"	2,600,000 "
" "	1888,	"	2,000,000 "

Taking into account wood from all ports, it is noticeable to what an enormous extent the stock has gradually swollen. This result is due largely to the new importations from various countries of so-called mahogany, also the great quantities of African and Panama wood that have come to hand, with several re-shipments from the United States. This bountiful supply no doubt will soon be discontinued, as prices cannot possibly be paying the shippers, and with a further fall in values, which is inevitable, some very serious losses will be made.

In addition, the imports from Cuba have shown an advance upon the averages of past years, and the importers, having deemed it advisable to hold these cargoes for high prices, are now realizing their mistake in swelling stocks to the excessive height which they have reached.

High-class logs still maintain their value, and are likely to continue doing so in view of the very small number obtainable from the various cargoes arriving. The prospect for inferior classes is a poor one, and a considerable fall in prices is anticipated unless supplies are strictly modified.

Cedar.—Stocks are not excessive, showing only 800,000 ft. super against 1,000,000 at end of 1892, and 1,700,000 in 1891. A large quantity of cedar was shipped during 1893 from Australia, but as the quality, colour and manufacture were

objected to by the trade, the result must have been very unsatisfactory to speculators. Boat-building wood still maintains its high figure, but box-making stuff is going fairly cheap.

SEQUOIA.—The importations have been considerable, and being far in excess of the demand, have caused prices to be very depressed. Stocks are now slightly reduced, but there is no improvement in prices.

ROSEWOOD.—A considerable increase in stock has led to very poor values, prices having dropped to the lowest point known for years. An exception is to be noted in the case of large planks of good figure, which are selling with much better results, some fetching as high as £18 per ton.

PADOUK.—Only a limited quantity has remained upon the market throughout the year, the supplies being light. A very steady trade has been done, although prices are low, as is naturally the case with all new woods, while mahogany and other competitive classes are ruling so cheap. The enquiries of late have been of a more general character, proving that the merits of this timber are being better appreciated.

GREENHEART.—Prices have declined throughout the year, and continue very depressed. The present stock is 780 loads.

AMERICAN WALNUT.—Logs have been imported in a greater number in the past year than for a period of five years, and this import has principally consisted of small and inferior parcels, which in many instances have been forced at public auction without reserve, realizing prices which must necessarily have shown a serious loss to shippers. Prime parcels, consisting of sound, clean logs of fair sizes, have realized good values and are still in demand at remunerative rates. Culls should not be shipped, as they are a drug in the market. The board trade for the first six months was in a fair position, but has much declined in the latter portion of the year. Good brands have been readily disposed of, and first quality wood is much in demand, but the rough grades will not pay for importation.

WHITEWOOD.—Logs have been difficult of sale, the imports being far in excess of the demand, and prices as a whole have been very low. This is only one of the consequences of the enormous importation of the prepared boards and planks, which, in the earlier portion of the year, were readily disposed of at full values, but the heavy later arrivals have, in a measure, swamped this trade, and prices have a downward tendency.

OAK.—The remarks above as to qualities apply equally to this wood, as, while the rougher parcels are almost unsaleable, first quality grades find ready buyers at full values. Many of the lower grade woods have been only disposable by auction without reserve, showing a very heavy loss to the shippers. Quartered planks, say 3 to 5 in. thick, 12 in. and up, are in good demand at full values. Plain wood has been too freely imported, and prices are, and will rule, much lower. Imports of this latter should be stayed.

The course of the hardwood trade throughout the year has not been of a very satisfactory character, and there are signs that an improvement in the coming year is more than probable, judging from the inquiries already on the market.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(From our own Correspondent.)

IN the engineering, shipbuilding, and allied trades in Scotland during the past month business, as is always the case, has been largely broken into by the New Year's holidays, which occupy at least a week, and in some instances from ten to fourteen days, thus reducing the working time to a maximum of three weeks. A great deal of faith is however placed in the indications of trade during that period, and we are glad to report that these have shown a tendency for the better. The coal exports from the nine principal shipping ports in Scotland, for the first three weeks of the year, show an increase of 74,807 tons as compared with the corresponding period last year, the figures being, this year 177,540 and last year 102,733. Whether this increase is due to a desire on the part of manufacturers to be prepared for the worst in the event of a renewal of the strike, or whether it can be accounted for by a firmer tone in commercial circles, it is difficult to say; but we prefer to put it down to the latter as being the most satisfactory belief to all concerned. Several new contracts have been booked by Scotch shipbuilders since the beginning of the year, though in the Clyde district what was expected to cause considerable competition has fallen flat. We refer of course to the estimate for the new battleship of the *Magnificent* and *Majestic* type, for which several firms expected to quote; but yards on the upper reaches of the Clyde, though on the Admiralty list for this class of work, have learned with regret that they will not be asked to tender owing to the shallowness of the Clyde above the Cart preventing the builders guarantee that after launching the vessel would float all the way down the river. We are anxious to hear what steps the Clyde Trust are prepared to take in order to prevent the occurrence of a similar difficulty with the next large Naval contracts.

Messrs. Scott & Co., Greenock, who, by the way, have contracted with the Ocean Steamship Co., of Liverpool, to build and engine two steel screw steamers of 4,000 tons each and 2,500 H.P., are tendering for this large battleship and for the engines also, and after the protracted period of idleness in their yard we wish them every success. Early in the month Messrs. R. Napier & Sons, Govan, booked an order for a large cargo steamer for an Aberdeen firm, also a smaller steamer for the Manchester Canal service.

The London and Glasgow Shipbuilding and Engineering Co., Limited, booked for their yard, next the above firm's, an order for the new Cunarder for the Boston route.

Messrs. Napier, Shanks & Bell, Yoker, whose yard has been rather dull, have received a contract for a twin screw steamer 320 ft. long for China, and about the same date the Campbeltown Shipbuilding Co. contracted with the General Steam Navigation Co., London, for a screw steamer to carry 2,800 tons. The most important contract for the month was the securing by Messrs. J. & G. Thomson, Clydebank, of the new cruiser *Terrible*, which will be one of the largest vessels of war built on the Clyde, being 500 ft. long.

Another notable fixture is the new yacht for the Khedive, which has been placed with Messrs. A. & J. Inglis, of Pointhouse. The new boat is to be something like 200 ft. in length, of about 700 tons, and in point of speed and equipment will be as fine an example of her class as ever left the Clyde. She will be sumptuously fitted, and the accommodation for the Khedive and his suite will be magnificently decorated. The Scottish Oriental Steamship Co. have, we understand, placed an order for a steamer of about 2,000 tons with the Fairfield Shipbuilding Co.

On the East Coast few new orders are reported, but the Leslie Shipping Co., of Aberdeen, have placed an order for a screw steamer of 1,600 tons register with Messrs. Hall, Russell & Co., of the same port. The vessel is intended for a general cargo trade in the Mediterranean and Baltic ports. Messrs. Hall, Russell & Co.'s offer was not the lowest, but it is with the object of providing work for the unemployed Aberdeen Shipyard hands that induced the company to place the order so near home.

All the yards in the Clyde district can boast of at least one vessel building, whilst on the lower reaches at Greenock and Port-Glasgow some of them are quite busy in appearance. In particular both Messrs. Russell & Co.'s yards are pretty full, and a total of eight vessels building at one time with more to lay down speaks for itself. Messrs Scott & Co. have laid the blocks for the two 4,000 ton boats reported above; Caird & Co. are busy with their P. & O. contract; Messrs. Dunlop & Co. and Messrs. Wm. Hamilton & Co. have each three vessels in various stages, whilst Messrs. Murdoch & Murray, R. Duncan & Co., Limited, and A. Rodger & Co., have each two to their credit.

Launches have been fairly numerous, and though one or two have been exceptional decidedly the launch of the month was that occurring at the Fairfield yard. We refer, of course, to the new Castle liner, *Tantallon Castle*, for full description of which we refer our readers to our "launch" columns. The new vessel is of 5,800 tons gross register, measuring 455 ft. in length over all, with a breadth of 50 ft. 8 in. by 35 ft. deep. She will be rigged with three masts, with yards on the foremast, and will be provided with one funnel. The engines, supplied by the builders, are of the quadruple-expansion type, with four cylinders working on four cranks. They are the largest of this type yet constructed, and the most powerful ever built for the Castle Mail Packet Co. The auxiliary machinery is powerful and extensive and we have no space to enumerate it here. The launch took place at 2 o'clock on the 23rd ult., before a very large concourse of spectators, and was, as is ever the case from the Fairfield yard, as successful as the most sceptical could desire.

Another event of the month was the formal opening, on the 22nd ult., of the new cattle wharf for American cattle at Pointhouse. In the new buildings and contiguous lairage, 4,000 cattle may be received at one time for inspection and slaughter. The

cost of the buildings with fittings will be about £40,000, and they are one of the largest in the United Kingdom.

The look-out of joiners in the Clyde shipyards has now reached a crisis, and as their action of late has been quite indefensible it is quite time that outside pressure should be brought to bear on their leaders, and more particularly on the men themselves. We have referred to this strike frequently and now place before our readers the actual cause of strife, when we feel sure that any sensible person will see that the cause of complaint is certainly not on the men's side. That such a trifle should be forcing firms in the Clyde to meditate, as several are doing, the transference of unfinished vessels to other ports for the completion of the internal fittings, is preposterous, and we sincerely trust a settlement will be effected before trade is entirely stifled. The bye-law, in the set prepared by the union, which is causing the lock-out, runs:—"Yards which may be working short time, and having jobs necessitating the working of longer hours than the short-time arrangement, members may work to the extent of full time, but must be paid at the rate of time and half for all time wrought over the short-time arrangement, and in no case must they work more than 54 hours per week." It so happened in Messrs. Thomson's yard at Clydebank that during the winter there was not full work for the outdoor squad, but there was ample work for the indoor men. When the arrangement was announced that the outdoor squad should work 40 hours, and the indoor squad 52 hours per week until further notice, the demand was at once made for pay at the rate of time and half for the 12 hours over 40. To show the absurdity of this, it has only to be mentioned that had the employers intimated that 52 hours would be the full-time week, but that for the present certain men would be required for only 40 hours, the claim would not have been raised. In any case, it was raised under a bye-law with the making of which the masters had no concern, and of the existence of which they were ignorant. It is preposterous to supppose that employers in any industry would or could afford to submit to such tyranny. It is perfectly certain that the men would not submit to it themselves were the position reversed. And the folly of the whole affair is particularly glaring at a time when work is becoming plentiful, when orders for new ships are coming in, and when the entire shipbuilding industry on the Clyde may be soon paralysed owing to progress being blocked beyond a certain stage by the joiners.

The new docks at Leith are progressing as well as can be expected at such an early stage, and in the course of a month or two a large draft of labour will be started, when matters will assume a busier aspect.

The trade of the docks, more especially in the way of coal shipments, shows a decided increase, though at present 20 steamers of fully 18,000 tons register are laid up at Leith. This is due to the presence of ice in the Baltic and Black Sea ports.

Since writing the above we have just received information that Messrs. Wm. Simons & Co., Renfrew, have received an order from the European Danube Commission for the construction of a 1,250 ton stern-well hopper dredger, to be employed in deepening the river Danube. The buckets will be of exceptionally large size. There will also be powerful sand-pumping appliances for operating on the Sulina bar. The construction of the vessel will be under the direction of Sir Charles Hartley, K.C.M.G., the consulting engineer of the Commission, and Mr. Wilson Wingate, C.E., London, inspecting engineer. When completed this bucket hopper dredger will be the largest and most powerful afloat.

TRADE NOTES FROM THE TYNE, WEAR TEES, HARTLEPOOLS, &c.

(From our own Correspondent.)

THE TYNE.

Shipbuilding.—Since the opening of the year, the outlook for the shipbuilding industry in this, as well as in other districts, has improved considerably and there is every reason to believe that in the present year work will be more plentiful than it was in the year just closed. The best proof of an increase in prospective business at the shipbuilding centres is to be found in the fact that steel and iron manufacturers have booked orders for shipbuilding material sufficient to keep their works going for months to come, and in some cases are so busy that they cannot guarantee delivery by specific dates. Notwithstanding this hopeful circumstance, however, it would be hazardous to say that we are on the eve of a great and general revival in shipbuilding such as was experienced half-a-dozen years ago. The depression that has supervened has not been so deep and prolonged as former depressions, and the void created by the partial slackening of production will consequently be more easily filled up. To many persons the advent of a moderate trade expansion which would not greatly affect prices nor provoke demonstrations of hositility between capital and labour, would be more acceptable than a tremendous "boom" which would produce both the results mentioned, and be in all probability shortlived. The signs of the times seem to indicate that the sober-minded persons referred to are likely to have their ideal fulfilled on the present occasion; but there is this consolation in the prospect, that if the trade revival is not going to come upon us with hurricane force, it is all the more likely to last for a reasonably long period. The condition of things at the Low Walker Yard of Messrs. Armstrong, Mitchell & Co., has undergone a change for the better, as there are now three vessels in course of construction—one of them a very large one—whereas a few weeks ago, there was absolutely nothing in hand. One of two large oil boats that had been laid down on the speculative principle early last year has been sold to Messrs. Samuels & Co., of London, and has since been put into the water. It is stated that alterations will be made in the internal arrangements of the vessel which will have the effect of adapting her to the carrying of other kinds of cargo besides oil. A large vessel named the *Frankfurt*, which formerly belonged to the North German Lloyds, has arrived at the yard, and is moored beside the s.s. *Herman*, which also belonged to the well-known Bremen owners, and was brought to the Tyne with another large steamer a couple of years ago. Messrs. Wood & Skinner, who last year had an exceptionally dull time in their establishment, have made a good start for the present year, as they have now one vessel in frame, and two others with the keels laid. The construction of these vessels will keep the yard busy for the next six months, and it is understood that there are others to follow. Messrs. Dobson & Co. have just launched a large vessel ordered by local owners, and have three others still in course of construction. Messrs. Wigham, Richardson & Co. launched, on the 22nd ult. a handsomely modelled vessel for American owners, and are preparing to lay down another vessel of a special type. They have two vessels in advanced stages on the stocks. Messrs. C. S. Swan & Hunter have, it is said, enough orders to keep their machinery going during the whole of this year. In the "west" yard there are three large vessels in various stages, and in the "east" yard (a comparatively recent addition to the area of the establishment) there are two in course of framing. The firm who, some time ago, added a splendidly equipped saw-mill and joiners' shop to their extensive premises, and more recently a new frame-turning and adjusting department, are now contemplating the erection of a blacksmith's shop, which will be in keeping with the other arrangements of the establishment. Other additions are also to be made with a view to facilitate to the utmost possible extent the carrying on of work in the various departments. At Messrs. Hawthorn, Leslie & Co.'s yard, work has become much brisker lately, and the outlook for the next few months is encouraging. Messrs. R. Stephenson & Co.'s yard continues to be kept fairly busy, though there are at present but two vessels on the stocks. The Palmer Co. are understood to have booked some further orders, and it is hoped that they may be successful in securing some additional Government work. They have, at all events, been invited to tender for one of the battleships about to be built. A commencement has already been made with the initiatory work of the torpedo destroyers ordered by the Admiralty a couple of months ago, and it is expected that the various departments of the works will be kept fairly busy over the present year. The stocks of the Tyne Shipbuilding Co.'s yard continue to be fully occupied, a keel having been placed in the berth from which the large oil steamer *Duffield* was launched a few weeks ago. The Edwards' Shipbuilding Co.'s yard is to be counted amongst the establishments that are moderately well employed, there being a couple of berths unoccupied; but at Messrs. Readhead's yard there is as much work in progress as can conveniently be dealt with. Besides the new work in hand, there are several vessels undergoing repairs at the quay. The Mercantile Dry Dock Co., Limited, have been kept very busy with repair work during the past few weeks.

Engineering.—The new engine and ship repairing works of Messrs. C. R. Toomer & Co., Tyne Docks, were formally opened on December 22nd, when a number of gentlemen connected with

shipping and marine engineering interests in the district were present by invitation. The visitors were shown through the premises, and several gentlemen afterwards expressed their admiration of the general arrangements and very complete equipment of the establishment. The business of ship and engine repairers was started by Messrs. Toomer so far back as 1872, and the opening of the new premises only marks an important development. The improvements in machinery which modern enterprise and ingenuity have brought about, have been fully availed of by the firm in fitting up the various departments, and there can be no doubt that their carefulness will have enabled them to offer to their customers and to shipowners generally, the fullest advantages in the way of economical and rapid execution of contracts. The works are situated close to the tidal basin, an excellent position for effecting repairs to vessels with the least possible degree of inconvenience. There is plenty of room for an extension of the premises at some future date, and as it is understood that the firm are not unprepared for such a contingency, it may be taken for granted that when the need for an extension arises, it will not be long delayed. The larger marine engine works are showing increasing business, and it seems probable that the number of unemployed operatives will soon be sensibly diminished. A significant and most satisfactory sign of the times is the fact that an order for a set of marine engines and boilers has been placed with a Gateshead firm that has been absolutely without work of this kind for more than a year. Messrs. Baird & Barnsley, of North Shields, are said to have received an important order for a steam yacht from Turkish owners, and as they have also a number of other orders, the state of business is likely to be good for some time to come. At the Jarrow Forge Co.'s Works orders are fairly plentiful, and Messrs. Eltringham's boiler works, South Shields, are kept in steady operation. Messrs. George Noble & Co., of 40, Westgate Road, Newcastle, have received from local firms a number of enquiries for various sizes of the "Yaryan" evaporator, for which speciality they are the agents. Two powerful "Yaryans" have recently been fitted in Chilian cruisers built at Elswick, and it is understood that an order has been received for one to be fitted in another cruiser, now in course of construction. Mr. Thomas Beynon, of No. 9, Dean Street, has, since the opening of the year, experienced an augmented demand for the various specialities in connection with which he is locally identified, including Engelbert's well-known lubricants, Walter's white marine glue, and the productions of the Irwell Rubber Co. The latter company have introduced a new method of armouring all kinds of rubber hose and tubing with the best wiped steel wire, and it is claimed that with the aid of special machinery provided for the purpose, the wire can be made to grip the hose with any degree of firmness required, without diminishing in the least its internal diameter. The company are in a position to supply this description of armoured hose and tubing at a moderate cost, and as they guarantee freedom from twist or injury to the hose in carrying out their process, a large demand for their speciality may be counted upon. Mr. W. F. Snowdon has been exceedingly busy during the month in covering with his well-known non-conducting composition, the boilers and steampipes of vessels recently engined in the district. Nearly a dozen contracts of this kind have been completed, among which were two oil ships of large capacity. Mr. Thomas Boydell, of Elswick Court, Newcastle, and formerly of Bath Lane, having largely extended the scope of his operations, and equipped the premises which he now occupies with improved machinery and appliances, is finding a satisfactory increase in the demand for ship and engine-room repeating telegraphs, electric bells for voice tubes, and other specialities of which he is the manufacturer. He has also engaged in the business of electro-plating, in which he has achieved a very marked success. Messrs. Swinburne & Sons, of the Wallsend Brass and Copper Works, are very busy just now, and are likely to continue so during the whole of the year. They have been specially successful in securing orders for the brass and copper work required in steamers, and are now engaged on work for a number of locally built vessels.

THE WEAR.

When anything in the nature of a general improvement in shipbuilding is manifested, it will naturally be assumed that Sunderland has not failed to participate in such improvement, and we are pleased to be able to state that on the present occasion the signs of increasing work are as apparent on the Wear as at other centres. Messrs. Pickersgill, whose yard has been inoperative for many months, have booked one or two orders, and the machinery of their establishment will again be in motion very shortly. Messrs. Wm. Doxford & Sons have been commissioned to build for a London firm a couple of very large "turret" steamers, and they have in hand two vessels of the same type for Newcastle owners. The frame-turning department at Messrs. Short Bros. yard is kept very busy, among recently booked orders being one for a vessel of large size from a firm of owners at Newcastle. Messrs. Osborne & Graham have a vessel about 350 ft. long nearly plated, and another of similar dimensions in the framing stage. Messrs. Priestman & Co. have four vessels in progress, and at Mr. Laing's yard the briskness noted a month ago is fully maintained. Messrs. J. L. Thompson & Sons are said to have enough work to keep their extensive establishment busy till the autumn. At present they have three vessels on the stocks, but it is expected that they will soon have other two berths occupied. Among the orders on hand those for local owners form no inconsiderable item. Just now the firm have a good deal of repair work to deal with at their Manors Quay establishment, and also in the Wear Commissioner's Graving Docks. Messrs. Bartram & Haswell launched a large vessel on the 22nd ult., and are preparing to put down another in the vacated berth. At the Sunderland Shipbuilding Co.'s yard a large vessel is being plated, and two of comparatively small dimensions are in earlier stages. Messrs. Austin & Son are plating a vessel, and frame-turning for another is proceeding. They are also well occupied with repair work. In the Bridge Dock (Messrs. R. Thompson & Son's) the s.s. *Ada*, of London, is undergoing a rather extensive overhaul. The yard opened at South Hylton by Messrs. McAndrew, Cowan, & Potts for the building of fishing vessels, small cargo boats, and other craft of a kindred type, is now fairly under way, and will, it is expected, in the course of a few weeks present an appearance of considerable briskness.

Engineering.—A decided improvement is noticeable in the marine engineering trade, and the whole of the four principal works on the Wear are much busier than they were three months ago. Night work has already been resorted to in more than one instance, and it is not improbable, that in a little time, this will become general. Messrs. Doxford are engining a very large vessel launched from their yard a short time since, and at the Southwick Engine Works there is also a vessel receiving her machinery. A large steamer belonging to Spanish owners has arrived at the Palmer's Hill works to be fitted with new boilers, and have such repairs as may be necessary, done to the engines. The North Eastern Marine Engineering Co. have several sets of engines in progress, and the pattern-making and iron founding departments are busy. There is a considerable increase of work at local forges, and the chain-making shops also show improvement. At the Monkwearmouth Ironworks business is now quite active, and orders are more plentiful than at any time during the past twelve months. At the Bloomfield Engine works considerable briskness continues to exist. the demand for the piston rod packing and other specialities manufactured at these works, being well maintained. Mr. John Wigham, of South Hylton, has introduced a new type of combined hand and steam steering gear, in respect of which it is claimed that the hand power is more than usually effective, and that owing to simplicity of design, any of the structural parts can easily be repaired in the event of an accident. Mr. Wigham has done a good deal of repair work to both the hulls and engines of vessels during last year, and his slipway has been almost constantly occupied.

The Hartlepools.—It is stated that Messrs. Furness, Withy & Co., have booked some important orders lately, and as Messrs. Wm. Gray & Co. are also well provided with work, the outlook at this centre is encouraging. During the past couple of months, the progress of work at the Central Marine Engine Works, West Hartlepool, has been most satisfactory, several important contracts having been completed. The s s. *Maori*, belonging to Messrs. Shaw, Savill & Albion Co., Limited, and built by Messrs. Swan & Hunter, of Wallsend, had a successful trial trip to London and has since left on her first voyage to New Zealand, where she will load 75,000 carcases for the home market. The engines in this vessel are the largest yet turned out at the Central Works and are fitted with all the latest improvements, and with Howden's system of forced draught. The s.s. *Chickahominy*, a vessel built by Messrs. Furness, Withy & Co., and engined at the Central Works, had a satisfactory trial trip and proceeded "north about" to America. This vessel has just returned to London

with her first cargo, having made the passage from Newport News to Gravesend in thirteen days. There has also been sent to sea the s.s. *Bullmouth*, the last of six large oil steamers, built by Messrs. Wm. Gray & Co., for Messrs. Samuel and Co., of London. Two other vessels sent to sea were the *Castanos* and the *David Mainland*. The former was a 5,000 ton vessel built by Messrs. Wm. Gray & Co., for Messrs. Morel Bros., of Cardiff, and the engines of which are an exact duplicate of those in the s.s. *Penarth*, referred to in a former number. The latter vessel was built for Messrs. Coverdale & Son, of West Hartlepool, and has made her first voyage most satisfactorily. There have also been fitted with machinery and returned to the builders the following vessels:—The s.s. *Aeolus*, built by Messrs. Swan & Hunter, for Messrs. Rickinson & Co., of West Hartlepool; the s.s. *Twilight*, built by Messrs. Furness, Withy & Co., for Messrs. John Wood & Co.; and the s s. *Pacific*, built by Messrs. Gray & Co., for Messrs. Cockerline & Co, of Hull. The figures representing the total output for 1893, which we published last month, amply prove how fully the Central Marine Works were employed throughout the year, and it is gratifying to know that during the present year there will be a fair amount of work available for the employés of this establishment. The outlook for the present year at Messrs. Richardsons' Works is, we are glad to say, also very satisfactory.

Stockton.—The whole of the Stockton yards are looking busier, and in connection with engine and boiler works, a very hopeful tone prevails. The following vessels engined at the works of Messrs. Blair & Co., have had their trial trips during December. The s.s. *Courtfield*, built by Messrs. Richardson, Duck & Co., of Stockton, for Messrs. Harris & Dixon, of London, having engines with cylinders 23½ in., 39 in., 64 in., by 42 in. stroke; the s.s. *Woolwich*, built by Messrs. Ropner & Son, for Messrs. Ropner & Co., West Hartlepool, having engines with cylinders 22½ in., 37 in., 61 in. by 42 in. stroke. The engines for these vessels were constructed to work at 160 lbs. pressure of steam, and at the trials worked most satisfactorily.

Middlesbro'.—It is understood that Messrs. Raylton, Dixon & Co. have secured a considerable amount of new work, among which may be mentioned a number of lighters or barges. Engineering and ironfounding establishments at this centre are showing signs of improvement. Steel works are extremely busy, and prices of plates and angles for shipbuilding have advanced.

Consett.—The Consett steel and iron works are now in full operation, and all departments are busy. The weekly output is, if anything, above the ordinary average.

THE MERSEY.

(*From our own Correspondent.*)

THE year so far has not developed any appreciable improvement in the general outlook as regards shipbuilding, marine, and general engineering work. Although in one or two other shipbuilding centres there are better prospects, there is no new work of any moment coming forward in this immediate district, and the position remains all through extremely unsatisfactory. The returns issued by the Engineering trades union organizations, which are generally a fairly reliable index of the condition of trade, still show considerably above the average number of members in receipt of out-of-work support. Of course, at the commencement of the past month, the returns included a considerable number of men temporarily thrown out owing to the holiday stoppage and stocktakings, and the temporary suspensions from the above causes would seem to have been much larger than usual. In the Manchester district they brought up the number of out-of-work members belonging to the Amalgamated Society of Engineers to more than 20 per cent. of the local membership, but towards the close of the month, more than half of these have again got to work, leaving the percentage still about 10 per cent., whilst the Steam Engine Makers' Society reports about 6½ per cent. of its total membership in receipt of out-of-work support. The societies, so far as out-of-work members are concerned, seem scarcely yet to have got over the disastrous effects of the protracted coal strikes of last year, and certainly this prolonged stoppage of the collieries is still having an effect upon the trade outlook generally. All descriptions of fuel for manufacturing purposes, are, owing to the absence of stocks, are keeping up at a price which is considerably above what is justified by the present depressed condition of the large coal-using industries, and this is necessarily tending to restrict the weight of new work that is being given out.

On both sides of the Mersey, shipbuilding continues exceedingly quiet, so far as new work coming forward is concerned. Messrs. Laird Bros., of Birkenhead, are kept fairly engaged, chiefly upon Government work, for home and abroad, but they are not nearly so busy as they were during the greater part of last year, and at present there is nothing really definite in the way of new work of any importance coming forward. On the Liverpool side of the Mersey, the shipbuilding trade remains in much the same depressed condition as reported for some time past, and no appreciable improvement can be reported as regards the position of any of the shipbuilding yards. Indeed, it would almost seem that shipbuilding as regarded in the light of anything like a prominent industry, is gradually dying out on the Liverpool side of the Mersey, owing to the keenness of competition in other shipbuilding centres, whilst as regards marine engineering, for a considerable time past there has been no work of any importance beyond repairs of machinery or the refitting of steamers.

The opening of the Manchester Ship Canal for traffic has very naturally tended to inspire more hopeful anticipations as to the future, but it is as yet far too early to form any really definite opinion as to what effect this new waterway will have in developing the industrial activity of Lancashire. For the present there is necessarily a considerable amount of rivalry between the port of Liverpool and the new port of Manchester. At Liverpool, meetings have been held of those most prominently connected with the interest and welfare of the old port on the Mersey, with a view of arranging and devising schemes which shall prevent the trade of Liverpool suffering to any serious extent by the competition of the Manchester Ship Canal. At Manchester, meetings of traders and others interested in the success of the Ship Canal, have also been held, with the object of securing as much trade as possible for their new waterway, which it is anticipated will do so much to help Lancashire to recover from the depression which has for some time past fallen over her staple industries. There would seem, however, to be no need for any undue jealousy between the two ports, as any increased activity which may be developed by the Manchester Ship Canal will more than compensate for any temporary loss which Liverpool as a port may perhaps for the time being sustain. So far, there has been a fair amount of traffic coming up to Manchester, but not perhaps to the extent which was at first anticipated. This in some degree has perhaps been due to the Canal, although open for traffic, not yet being dredged throughout its entire length to the full depth of 26 ft., and to many other arrangements which will still have to be made before Manchester, as a port, can be considered fully equipped for dealing with any kind of traffic which may have to come up the Canal. The largest vessel so far has been one drawing 22 ft., and this was more than the Ship Canal was able to take on the day of opening. No doubt in the course of the next few months, should everything go well, the opening of the Manchester Ship Canal will lead to the development of numerous industries along its banks, and many of the large engineering establishments in the district have for some time past had in contemplation the erection of works for various engineering requirements. At present, no important move has as yet been made in this direction, beyond the construction of pontoon docks by a North of England firm. As, however, the Ship Canal develops new industries along its banks, we shall record, from time to time the progress of events such as form matters of interest for our readers.

For the greater portion of the past month, only a slow business has been doing generally in the iron trade, and prices have scarcely been maintained at full rates which were quoted at the commencement of the year. In pig iron local makers have only been able to do any weight of business where they have had specially favourable rates of carriage, their chief customers being in the neighbourhood of Warrington, where they have been able to sell moderate quantities of forge iron at about 43s. to 43s. 6d., and foundry qualities at about 44s., less 2½. With regard to district brands, Lincolnshire makers have had to ease down a little to secure business, forge qualities, which were firm at the commencement of the month at about 42s. to 42s. 6d., having been sold at 41s. 6d., foundry qualities getting down to 42s. 6d. net cash, delivered Manchester, but with the close of the month prices have hardened up quite 1s. per

ton, and a considerable business has been done. Middlesborough iron has maintained generally a firm tone, and has slightly hardened up if anything towards the close of the month, good foundry qualities not being obtainable at anything under 44s. 10d. to 55s. 4d. net cash, delivered Manchester. In Scotch iron also, the tendency with the close of the month has been decidedly upwards; and Eglinton, delivered at the Lancashire ports, is now quoted at about 48s.; Glengarnock, 50s.; Gailsherie, 51s. net prompt cash

Manufactured iron makers, who at the commencement of the month had generally arrears of orders accumulated during the coal strike, which kept them fully going for some weeks, have not been securing any great weight of new business, and they have had to ease down somewhat in their prices, Lancashire bars, which were at first generally quoted at nothing under £5 15s., having since readily obtainable at £5 12s. 6d., whilst sheets and hoops are about the same figure as they were before the strike, Lancashire sheets averaging £7 5s. to £7 7s. 6d., and Lancashire hoops, £5 17s. 6d. for random and £6 2s. 6d., for special cut lengths, delivered in the district. A stronger tone is, however, reported with the close of the month.

The steel trade has continued very quiet, with prices about stationary, though weak, if anything; good foundry hematites in any quantities have been sold for delivery in the district at under 52s., less 2½, with small engineers' parcels quoted at about 1s. above the figure; steel billets have been extremely low in price, owing to Continental competition, and £4 2s. 6d. to £4 5s., according to quality, are about the average figures for delivery here. In manufactured steel, good boiler plates have fluctuated from £6 7s. 6d. to £6 10s., with steel bars readily obtainable at about £6 2s. 6d. delivered. With the close of the month there has been considerable activity in manufactured steel, and prices for bars and plates have gone up 2s. 6d. to 5s. per ton.

In the metal market business has been only very slow, with prices tending downwards for some classes of manufactured goods, list rates for delivery in this district being now as under: Solid drawn brass boiler tubes, 5¾d.; solid drawn brass surface condenser tubes 6¾d; solid drawn copper tubes, 7¼d.; brazed copper gas and steam tube, 7d.; brazed brass gas tube, 6½d.; brass wire, 5¼d.; copper wire, 6½d.; rolled brass, 5d.; sheet brass, 6d.; yellow metal bolts, 5¼d.; yellow metal condenser plates, 5¼d.; cast composition sheathing nails and spikes, 5¾d.; cast red metal sheathing nails and spikes, 7¼d.; wrought copper rivets, 8½d.; wrought copper boat nails, 8¾d. to 9½d.; wrought copper tacks, 11½d. to 1s. 2½d.; cut copper nails, 8d. to 9½d. per lb., and copper bolts, £61 per ton.

In the timber trade the market continues generally dull, with moderate imports, and stocks of all articles ample for present requirements. With the exception, however, that spruce deals are slightly lower, prices are without any very material change. East India teak has arrived to a limited extent but with only a small consumption; stocks continue heavy but there is no change in value. Greenheart has gone very freely into consumption, and the latest sales show an advance in value, although stocks are still ample.

In the coal trade there has been a fair demand for all descriptions of fuel, and the absence of stocks has tended to keep up prices, but with the close of the month the tendency is rather in a weakening direction, owing to the competition from other districts, especially Yorkshire. The better qualities of round coal, such as Wigan Arley, do not average more than 14s. to 14s. 6d., second qualities, such as Pemberton 4-ft., 12s. 6d. to 13s, with common round coals for steam and forage purposes, about 10s. to 10s. 6d. per ton, at the pit-mouth. Engine classes of fuel have been rather plentiful, and there has been a good deal of slack coming in from other districts, with the result that prices have had to give way somewhat during the month. Good qualities of burgy average about 8s. to 8s. 6d., best qualities of slack, 6s. to 6s. 6d., and common sorts of slack, 5s. to 5s. 6d. per ton, at the pit-mouth.

In the shipping trade there has been rather a scarcity of supplies, owing to a good inland demand, and prices have consequently got up, although in odd cases as low as 11s. 6d. has been taken for Lancashire steam coal, delivered at the ports on the Mersey, but at a meeting of the principal sellers held in Liverpool during the month it was decided that 12s. should be the minimum figure, and in some cases shipping houses reported that they were getting considerably above this without difficulty, whilst many of them were considerably over-

NORTH-WEST OF ENGLAND.

(From our own Correspondent.)

Barrow.—A marked improvement has taken place in the shipbuilding trade of Barrow during the past two months. In November last there was practically no work in the yard, and now the Naval Construction & Armaments Co. have in hand contracts which represent employment for fully two years to come. In addition to the 6,000 tons steamer building for Mr. Royden, of Liverpool, and a twin-screw channel steamer for the Dublin and Mersey Steamship Co., and three 3,000 tons steamers for cargo and passenger service for the Clan Line, Cayzer, Irvine & Co., and placed by Mr. C. W. Cayzer, the member for Barrow, the Naval Construction & Armaments Co. have been instructed to build two steamers for the British and African Steamship Co. of the same type as the *Accra*, *Bathurst*, and the *Batanga*. The Barrow Co. have also on hand three torpedo-boat destroyers which are to be fitted with patent water-tube boilers, the patent of Mr. Blechynden, the manager of the engine department at the Barrow works. The torpedo destroyers are to steam at 27 knots per hour. The Naval Construction Co. have also received a contract from the Admiralty for the building of H.M.S. *Powerful*, one of the fast cruisers embraced in last year's naval programme. The Barrow Co. have also the boilers and engines for these steamers to build, and in addition have also the machinery for H.M.S. *Majestic*, which is being laid down at Pembroke. Further than this they have something like a dozen repair orders on hand, many of which represent a considerable amount of work, so that altogether Barrow builders are very full, and it is quite on the cards that other important contracts will be entrusted to them in the early part of this year. They have been invited by the Admiralty to tender for the construction of a first-class line of battleship of the same type as the *Magnificent* and *Majestic*, and the Barrow yard is one of the best places in the country where heavy vessels of this description can be launched with perfect safety. Towards the close of last year short time was commenced in the Barrow yard with a view, there being so much distress in the town, to employing more hands. Full time is, however, now being worked, and a double shift will be put in the engine department, and large numbers of workmen are daily arriving in Barrow from the Clyde, Belfast, Newcastle, and other places where things are not so brisk as they are at Barrow.

Shipbuilding Material.—The Barrow Steel Co. commenced a fortnight ago the rolling of ship-plates by a new process with which they have been experimenting with. These experiments have been going on with a view to cheapening the cost of plates. The process is to take it and roll it from the ingot by one heat by means of a soaking pit, instead of as by the old process of re-heating after the ingot has been slabbed. Considerable experiments have taken place, and they have turned out satisfactory, and is of considerable importance to Barrow as a centre of the shipbuilding industry. Some discussion has taken place in the local papers on the subject, and it has been pointed out that Barrow is the one spot in the country where all classes of shipbuilding material and shipbuilding requirements such as forgings, &c., can be most profitably carried on. It will be interesting to see what result is achieved from the efforts that are being put forward, and from the disposition on the part of some capitalists associated with the steel trade to locate other industries at Barrow.

Triple-expansion Engines.—Herr Schichau, of Elbing, has an order to construct triple-expansion engines for three battleships of 5,500 tons displacement, 9,000 H.P., and 17·5 knots speed, that are now being built by the Austrian Government.

Thornycroft's Water-Tube Boilers.—As evidence of the appreciation in which the results of the very satisfactory steam trials of H.M.S. *Speedy* are held by the German naval authorities, it is announced that it has been decided to fit the new German battleship *T. Siegfried* Class, of 3,600 tons, with eight of Messrs. Thornycroft's patent water-tube boilers, instead of those of the locomotive type, the construction of which had already been commenced in Germany.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Greta Holme.—On December 21st there was launched by Messrs. Joseph L. Thompson & Sons, at Sunderland, a steel screw steamer, to the order of Messrs. Hine Brothers, of Maryport, of the following dimensions, viz.:—Length, 325 ft.; breadth, 41 ft.; depth of hold, 26 ft. 6 in.; built under special survey for Lloyd's highest classification. The engines and boilers are by Messrs. George Clark, Limited, of Southwick Engine Works, and are of the triple-expansion type, having cylinders 23 in., 38 in., and 62 in. diameter respectively, with a stroke of 42 in. The vessel, which will have a carrying capacity of about 4,100 tons, was christened *Greta Holme*.

Barnstable.—On December 22nd Messrs. R. Craggs & Sons launched from their Middlesbrough yard, a handsome passenger steamer for the Jamaica and Boston, U.S.A., trade. Her dimensions are:—Length, 240 ft. 6 in. by 31½ ft. beam and 17 ft. 2½ in. depth to main deck. She is awning-deck type, and will be fitted with special fast running triple engines of about 1,700 I.H.P., by Messrs. Westgarth, English & Co., of Middlesbrough; steam is supplied by boilers of extra size at 160 lbs. pressure. She is built to highest class at Lloyd's and Board of Trade requirements, and will have handsome accommodation in large deck-house forward of engines. A comfortable smoke-room, promenade deck, and complete electric lighting installation are provided. The holds are arranged and specially ventilated for the conveyance of fruit. On leaving the ways the vessel was named the *Barnstable*, by Miss Craggs. She will be fitted out under the superintendence of Captain Anderson, of Boston, U.S.A.

Wolf.—On Friday afternoon, December 22nd, Messrs. Richardson, Duck & Co. launched from their yard a steel steamer of the following dimensions, viz.:—Length over all, 300 ft. 6 in.; beam, extreme, 42 ft.; depth, moulded, 20 ft. This vessel, which has been built to the order of Messrs. Farrar, Groves & Co., of London, will class 100 A1 on Lloyd's Register, and has been built under special survey. She is of the partial awning-deck type—captain and officers being berthed in poop aft, engineers in house on fore end of quarter-deck, and crew in 'tween decks alongside fore hatch. A cellular double bottom throughout, and after-peak are fitted up for water-ballast. Vessel will be schooner-rigged, and her equipment includes steam windlass, stockless anchors, steam steering gear, four steam winches, large donkey boiler, and all modern appliances for speedy loading and discharging. Engines of 900 I.H.P. will be fitted on board by Messrs. Blair & Co., of Stockton. As the vessel left the ways she was christened *Wolf* by Mrs. Joseph Richardson, of Potto Hall.

Indralema.—There was successfully launched on Saturday afternoon, December 23rd, from the East Yard of the firm of Messrs. C. S. Swan & Hunter, shipbuilders, Wallsend, a finely-modelled steel screw steamer of the following dimensions:—Length over all, 341 ft.; breadth, 41 ft. 6 in., with a moulded depth of 28 ft. 1 in. The vessel, which is a fine specimen of the most improved type of modern general cargo steamer, has been built to the order of Mr. T. B. Royden, Liverpool, her hull having been built under the superintendence of Captain Gardiner, and her engines under that of Mr. Goodwin, Liverpool. Her engines are by the Central Marine Engine Works, West Hartlepool, with cylinders 24 in., 38 in., 64 in., and 42 in. stroke. She has been built on the three-deck type, with full poop, topgallant forecastle, long bridge, and spacious deck houses. The vessel, on leaving the ways, was named *Indralema*, by Miss Hunter, of The Willows, Jesmond.

Swansea.—On Saturday, December 23rd, there was launched from the shipbuilding yard of Messrs. W. Harkess & Son, Middlesbro', a steel-screw steamer of the following dimensions:—Length, 200 ft. 9 in.; breadth, 32 ft.; depth, 15 ft. 10 in.; which has been built to take the highest class at Lloyd's. The vessel is specially designed with large cubic capacity for the coal trade, and has all the most modern improvements for navigation and quick despatch, whilst her extremely large hatchways, 40 ft. 3 in. by 18 ft., make her practically a "self trimmer." She is of the well deck type, with open forecastle, bridge house for accommodation of captain and officers, and raised quarter deck aft, is designed to carry a large cargo on a light draught of water, has deck machinery by the best makers, and will be fitted with engines and boilers by the North-Eastern Marine Engineering Co., Limited, of Sunderland, having cylinders 17 in., 28 in., and 46 in. diameter, by 30 in. stroke, working at a pressure of 160 lbs. On leaving the ways she was christened *Swansea*, by Miss Lynn, of Blyth.

Stefania.—On December 23rd a steel screw steamer was launched by Messrs. Wigham, Richardson & Co., from their Neptune Shipyard, Newcastle-on-Tyne. The vessel is being built to the order of the Royal Hungarian Sea Navigation Co., Adria, of Fiume and Budapest, and is 293 ft. in length by 39 ft. 9 in. beam. She will be rigged as a two-masted schooner. The engines and boilers are also being constructed by Messrs. Wigham, Richardson & Co. The vessel, with her outfit, engines and boilers, is being constructed under the superintendence of Mr. Alexander Rolland, who was present at the launch. As the vessel left the ways she was named the *Stefania*, the ceremony being performed by Mdlle. Marechal, of Paris.

Patria.—On December 28th Messrs. Laird Brothers launched from their works, at Birkenhead, a twin-screw steel torpedo cruiser, built to the order of the Argentine Government. This is the fifteenth vessel built by this firm for the Argentine Navy. She was named *Patria*, the christening ceremony being performed by Mme. Massot, wife of Lieutenant-Commander Massot. The Argentine Minister was unable to be present, but the Naval Commission was represented by Captain Manuel Barraza and Mr. T. W. R. Hughes, the Government inspecting engineer. The *Patria* may be described as an enlarged and improved vessel of the *Halcyon* type in the British Navy. An important departure from the vessels of her type in the British Navy is the substitution of a complete spar deck for the poop and forecastle. She has a length of 250 ft., with 30 ft. beam and 16 ft. depth, and her tonnage is 1,183 tons O.M. The machinery, which is complete in Messrs. Laird's shops ready for putting on board, consists of two sets of triple-expansion engines of 1,250 H.P., each driving a three-bladed propeller with steel boss and manganese bronze blades: distillers and evaporators of large capacity, and complete electric installations in duplicate are provided. The boilers are of steel, four in number, of the locomotive type, working at a pressure of 155 lbs. per square inch, to be worked under the closed stokehole system. The armament will comprise quick-firing guns, machine guns, and five torpedo tubes.

Maroa.—On Thursday afternoon, January 4th, Messrs. William Doxford & Sons, Limited, successfully launched from their yard at Pallion, a very large cargo vessel built to the order of Messrs. Crow, Rudolf & Co., of Liverpool. She is in almost every respect a duplicate of the *Samoa*, launched by Messrs. Doxfords in Oct. 1892, for the same owners, which ranked as the largest vessel built on the Wear, and indeed the largest deadweight cargo vessel in the world, and which caused so much interest in this country and America. The vessel, which is built of steel, and classed 100 A1 at Lloyd's, is 465 ft. in length, 52 ft. in breadth, and 34 ft. 8 in. in depth; has a gross register of 6,800 tons, deadweight capacity of 9,550 tons on 25 ft. 11 in. draught. The engines, also built by Messrs. Doxfords, have cylinders 30 in., 49 in., 78 in., and 51 in. stroke, which are supplied with steam from three double-ended boilers, and will drive the vessel 10½ knots when fully loaded. She is built on the spar-deck principle, with double bottom right fore and aft, and is intended for "general trade"; has a forecastle 53 ft. long, bridge, 94 ft., poop, 34 ft., and is fitted with six watertight bulkheads. The vessel is fitted with nine 7 ft. by 12 ft. steam winches, one steam windlass, and three steam capstans, one forward and two aft, all made by Clarke, Chapman & Co., Gateshead. The steering gear is made by Fawcett, Preston & Co., Liverpool. There are two vertical donkey boilers, to supply steam to the deck machinery. The vessel will be fitted with electric light throughout, and has been under the superintendence of F. J. Pilcher, Esq., of Liverpool.

Enplectela.—On January 6th, Messrs. Armstrong, Mitchell & Co., launched at their Walker shipyard the *Enplectela*, for Messrs. M. Samuel & Co., of London. She is a spar-deck vessel 340 ft. in length, 44 ft. beam, and has a moulded depth of 31 ft., and is being superintended by Messrs. Flannery, Baggallay & Johnson, of London and Liverpool, and Capt. Coundon, marine superintendent, and is to be fitted with all the latest improvements for the carriage of oil in bulk and general cargo. She is subdivided into numerous tanks with a total capacity of 4,860 tons of oil and large bunkers. She will be fitted with a very complete installation of auxiliary engines, consisting of cargo,

pumping, ballast pumping, ventilating, and electric lighting machinery, as well as steam windlass, steering gear, and a full complement of powerful steam winches, and derrick gear for the quickest despatch of general cargo. The engines and boilers will be capable of propelling the vessel at fully 10 knots at sea, and will be fitted by the Wallsend Slipway Co., of Wallsend.

Hambleton.—On January 8th Messrs. Ropner & Son, of Stockton, launched one of their specially-designed cargo steamers, of the following dimensions, viz:—Length over all, 324 ft.; breadth, 40 ft. 6 in.; depth, 23 ft. 7 in. The vessel has a break poop, in which is fitted spacious accommodation for captain and officers; a raised quarter-deck and part awning deck, the latter extending right forward. Accommodation for the engineers is fitted in a large iron house on deck. She has large cubical capacity in her holds and 'tween decks, and will carry a large deadweight cargo. Her water ballast is carried in a cellular bottom, and in the after peak. Four large steam winches will be fitted, steam to these being supplied by two large donkey boilers, working at 160 lbs. pressure; she has steam steering gear amidships and screw gear aft, patent windlass, and all the latest improvements and appliances for a first-rate cargo steamer. Her engines are by Messrs. Blair & Co., of about 1,200 I.H.P., with two large steel boilers working at 160 lbs. The steamer was named *Hambleton* by Miss Gilling, of Sowerby, Thirsk, and will be registered at West Hartlepool.

Ribston.—On Monday, January 8th, Messrs. Wm. Gray & Co., Limited, launched a fine steel screw steamer, which they have built to the order of The London and Northern Steamship Co., Limited (Messrs. Pyman Bros., London, managers). Her dimensions are, length over all, 340 ft., breadth, 43 ft.; depth, 28 ft. 9 in. She will take Lloyd's highest class, and is built to the spar deck rule with steel main and spar decks. The hull is built with web frames and cellular double bottom throughout. Full poop containing saloon, staterooms, and accommodation for captain and officers; bridge house with engineers' rooms; and topgallant forecastle, in which the crew will be berthed. All the arrangements have been designed to suit the rapid handling of general cargo, and the equipment includes patent direct steam windlass, patent steam steering gear amidships, screw gear aft, four powerful steam winches, and two large donkey boilers, &c. Fine triple-expansion engines of 1,250 H.P. are being supplied by the Central Marine Engine Works of Messrs. Wm. Gray & Co., Limited. The cylinders are 24 in., 38 in., and 64 in. diameter, and the piston stroke 42 in. Two fine steel boilers will supply steam at a working pressure of 160 lbs. per square inch. The ceremony of naming the steamer *Ribston* was gracefully performed by Miss Evelyn Baines, of West Hartlepool. The ship has been built under the superintendence of Captain T. Pyman, on behalf of the owners.

Berlin.—On January 10th Earle's Shipbuilding Co. launched at Hull a twin-screw steamer, which they have built for the Great Eastern Railway Co.'s Continental service between Harwich and the Hook of Holland. This vessel, which was named the *Berlin*, is a steel twin-screw steamer, 302 ft. in length, by 36 ft. beam, has two separate sets of triple-compound engines, which are expected to give a speed of about 18 knots an hour. The cabin accommodation is similar to the *Chelmsford*, which was built by the same firm for the Hook of Holland route last summer, the *Berlin* being a sister ship with the exception that she has a little more length and beam. The Great Eastern Railway Co. intend to have four boats of this type to perform the service.

Roumiantzeff.—On January 20th Messrs R. & W. Hawthorn, Leslie & Co., Limited, launched at Hebburn-on-Tyne, a steel passenger paddle steamer named *Roumiantzeff*, built to the order of the Russian Steam Navigation and Trading Co., for their service on the Odessa and Kherson line. The vessel is 221 ft. long, 28 ft. broad, and 14 ft. 6 in. deep. The machinery consists of a set of compound diagonal surface condensing engines, having cylinders 32 in. and 61 in., with a stroke of 51 in.

Port Elliot.—On January 20th Messrs. William Dobson & Co. launched at Low Walker a steel screw steamer named *Port Elliot*, built to the order of Messrs. William Milburn & Co., for their "Port" line of steamers. The dimensions of the vessel are:—Length over all, 357 ft.; breadth, 44 ft.; depth, moulded, 28 ft. 8 in. Triple-expansion engines are to be fitted by the Wallsend Slipway and Engineering Co., Limited, the cylinders being 24 in., 40 in., and 64 in. diameter and 45 in. stroke.

Clearwater.—On January 22nd Messrs. Wigham, Richardson & Co. launched from their Neptune Shipyard, Newcastle-on-Tyne, a very finely modelled steel screw steamer, built to the order of the New Orleans, Belize, Royal Mail and Central American Steamship Co., Limited, of New Orleans, and destined to run between that port and Central America. The steamer is 240 ft. in length by 33 ft. beam. She is very completely fitted up for the carriage of fruit, for which purpose she is provided with very powerful engines also by Messrs. Wigham, Richardson & Co., calculated to drive her at a high speed. The construction of the steamer, her machinery and boilers, is proceeding under the superintendence of Captain Macfarlane, who was present at the launch. The vessel was named the *Clearwater*, the ceremony being performed by Miss Dora Richardson, of Wingrove House, Newcastle.

King Bleddyn.—On Monday, January 22nd, there was launched from the yard of Messrs. Robert Thompson & Sons, Southwick, a finely modelled screw steamer, built for the "King Line" Steamship Co., of Glasgow, Messrs. Phillips & Co., managing owners. Dimensions:—Length over all, 295 ft.; breadth, 41 ft.; depth moulded, 20 ft. 3 in. Class 100 A1 at Lloyd's. Built on the long bridge and web-frame principle, and is designed to carry a large cargo on a light draught; cellular double bottom for water ballast; schooner rig masts being arranged for vessel to go through the Manchester Ship Canal bridges. She has four very large hatchways and steam winches. The cabin is in poop, aft, having large spacious rooms for the accommodation of the captain and officers. The engineers' quarters are amidships and the crew are placed in the forecastle. Engines by Blair & Co., Stockton. During the construction the ship and machinery have been under the personal supervision of Mr. W. B. Cumming, of Liverpool, and Mr. Curry, chief engineer. As the vessel left the ways, she was gracefully christened *King Bleddyn* by Mrs. Ivor Phillips.

Navarino.—On January 22nd Messrs. Ropner & Son launched at Stockton a steel steamer named *Navarino*, of the following dimensions, viz.:—Length over all, 295 ft.; breadth, 40 ft. 6 in.; depth, 21 ft. Her engines are by Messrs. Blair & Co., Limited, of about 1,000 I.H.P., with two steel boilers working at 160 lbs. The steamer has been built to the order of London owners.

Rounton.—On Tuesday, January 23rd, Messrs. Wm. Gray & Co., Limited, launched a fine steel screw steamer, which they have built to the order of the London and Northern Steamship Co. Limited (Messrs. Pyman Bros., London, managers). The vessel will take Lloyd's highest class, her dimensions are:—Length over all, 310 ft.; breadth, 42 ft.; and depth, 20 ft. 10 in. The deck erections consist of a poop, raised quarter-deck and partial awning deck. The saloon and cabins are aft, the engineers' rooms in the after part of the awning deck, and crew's accommodation forward. The hull is built on the web-frame system with cellular double bottom throughout. Large hatchways are fitted, four steam winches, steam steering gear amidships, screw gear aft, two donkey boilers, patent direct steam windlass by Emerson, Walker & Co., and shifting boards throughout, boats on beams overhead, two masts with schooner rig, and all modern working appliances will be fitted for general trading. The Central Marine Engine Works of Messrs. Wm. Gray & Co., Limited, supply first-class triple-expansion engines, having cylinders 23 in., 36½ in. and 62 in. diameter, with a 32 in. piston stroke, and two large steel boilers to work at 160 lbs. pressure per square inch. The vessel and machinery have been built under the superintendence of Captain T. Pyman, and Mr. W. Cromar on behalf of the owners, and the ceremony of christening the steamer *Rounton* was gracefully performed by Miss Ella Pyman, daughter of Mr. Walter Pyman, of Whitby.

H.M.S. Lynx.—On January 24th one of the new class of torpedo-boat destroyers was launched from Messrs. Laird Brothers Works. She is a sister ship to H.M.S. *Ferret*, launched from the same yard last month, and which is now nearly ready for trial. The engines and boilers of the *Lynx* are ready and will be at once placed on board and the vessel pushed on towards completion. The christening was performed by Miss Mary Laird, daughter of Mr. William Laird. Mr. J. C. Smale, visiting Admiralty overseer, and a small party of ladies and gentlemen were present.

Jamesia.—Messrs. Cochrane & Cooper have lately launched at Grovehill, Beverley, a well-line fishing vessel, built to the

order of the North-Eastern Fishing Co., Grimsby. The vessel, which is 105 ft. by 21 ft. by 11.6 ft., will be engined with 50 N.H.P. triple-expansion engines, by Messrs. C. D. Holmes & Co.

George Fox.—Mr. Henry Scarr has lately launched at Beverley, an iron keel, built to the order of Mr. Hugh Fox, of Derwent House, Elvington, near York. The vessel, which is intended for trade on the Derwent, is of the following dimensions:—Length, 56 ft.; beam, 14 ft.; depth, 6 ft. 3 in.

Thrift.—Mr. Henry Scarr has lately launched at Beverley an iron keel, built to the order of Mr. Charles Barker, of Stockwith, near Gainsborough. The vessel is intended for the Hull and Trent trade, and was named *Thrift*. Her dimensions are:—Length, 61 ft. 6 in.; beam, 15 ft. 6 in.; depth, 7 ft. 9 in.

LAUNCHES—Scotch.

Blackpool.—There was launched on December 19th, from the yard of Messrs. Murdoch & Murray, a steel twin-screw hopper barge of the following dimensions:—Length over all, 135 ft.; breadth, 24 ft. 2 in.; depth moulded, 10 ft. The vessel is to the order of the Lancashire and Yorkshire and London and North Western Railway Co.'s, and has been especially designed to meet the companies' requirements for carrying dredged material from Fleetwood harbour to sea, extra strengthening having been introduced to enable the vessel to stand the heavy local strains caused by the cargo being taken on board while the vessel is aground. The vessel presents a marked contrast to the usual style of hopper barge, the heavy and ungainly hopper beam being dispensed with, and all the doors are wrought from the side of the vessel by a special arrangement of chains and screws for opening and closing. A poop is placed aft with substantial erections over the engine and boilers, affording excellent protection in heavy weather. The sleeping apartments for captain, engineers, and crew are placed in the forward end, being neatly and comfortably fitted up. Apparatus has been provided for towing, and in fine weather auxiliary barges will be taken in tow. The vessel was gracefully named *Blackpool* by Miss Gibson, a daughter of Mr. A. S. Gibson, the companies' superintendent, and there were present several ladies, and, representing the railway companies, Mr. Gibson, Mr. Maloch, Captain Bond, Mr. Hayes, and Mr. Smith. After the launch the vessel was towed to Greenock to receive her machinery, which is to be supplied by Messrs. Rankin & Blackmore, and consists of two sets of their patent triple-expansion surface-condensing engines, having cylinders 9 in., 18 in., 32 in., by 22 in. stroke, steam being supplied at a pressure of 160 lbs. The vessel will be ready for sea shortly, and a speed of fully nine knots loaded is confidently expected. It is worthy of note that both Messrs. Rankin & Blackmore and Messrs. Murdoch & Murray have already supplied vessels to the same companies which have given every satisfaction, as the present contract shows. A sister vessel to the *Blackpool* will be launched in a few weeks.

Zinita.—On December 21st Messrs. Charles Connell & Co. launched at Scotstoun, Whiteinch, the steel sailing barque *Zinita*, built to the order of Captain J. D. Clink, shipowner, Greenock. She registers about 1,630 tons, has been built to the highest class in Lloyd's.

Merganser.—On December 23rd there was launched by Mr. James Millar, at St. Monan's, a new steam liner, built to the order of Mr. T. F. Carr, Aberdeen. The vessel was named the *Merganser*. Her dimensions are:—Extreme length, 91 ft.; length of keel, 86 ft.; breadth of beam, 19 ft.; and depth of hold, 8 ft. 9 in.

Barque.—On December 23rd there was launched from the shipbuilding yard of Messrs. Archibald M'Millan & Son, Limited, Dumbarton, a finely modelled steel barque of about 1,320 tons net register, which has been built to the order of Messrs. W. S. Kennaugh & Co., Whitehaven.

Devonia.—On December 23rd Mr. John Gilmour launched from his shipbuilding yard at Irvine a cargo steamer named the *Devonia*. Her dimensions are:—Length, 90 ft.; breadth, 18 ft.; depth, 8½ ft. She is classed 100 A 1 at Lloyd's, "iron," and is intended for service in the Bristol Channel. She is built to the order of the Bideford and Bristol Steamship Co. Her engines of 300 H.P. are to be supplied by Messrs. Muir & Houston, Glasgow.

Macerena.—On December 23rd there was launched from the shipbuilding yard of the Grangemouth Dockyard Co., at Grangemouth, a handsomely modelled steel screw steamer of the following dimensions:—230 ft. by 32 ft. by 17 ft. She is classed 100 A1 at Lloyd's, under special survey. The engines are being fitted on board by Messrs. Hutson & Son, Kelvinhaugh Engine Works, Glasgow, and are of the latest improved triple-expansion type. The vessel has been built to the order of the Campania de Navyationale Du Seville. The steamer was named the *Macerena* by Miss Wilkie, The Elms, Liverpool. The vessel is intended for the Spanish coasting trade.

Halifax City.—On December 26th Messrs. Alex. Stephen & Sons launched from their yard at Linthouse a steel screw steamer of the dimensions, 300 ft. by 37 ft. by 25¾ ft., and about 2,250 tons, built to the order of Messrs. Furness, Withy & Co., Limited, of London and West Hartlepool, &c., for their Nova Scotian and New Brunswick trade. This vessel has an elegant appearance, and is built in excess of the requirements for the highest or 100 A1 spar-deck class in Lloyd's. She has accommodation of a superier kind for about 40 first-class passengers. Her saloon is fitted in dark and light oak, with hand-painted panels of fruit and flower subjects. She has electric light throughout and electric bells, and is replete with every modern comfort and convenience. Her engines are of triple-expansion type, having cylinders 25 in., 40 in., and 66 in. diameter by 45 in. stroke, with 160 lbs. working pressure. The vessel was gracefully named *Halifax City* by Mrs. Harrison, wife of Captain Harrison, the commodore captain of the Furness Line, who is to take command of the new ship.

Glasgow.—There was launched at Dundee on January 6th a screw steamer, christened *Glasgow*, for Messrs. James Rankine & Son, Glasgow and Grangemouth, constructed by Messrs. W. B. Thompson & Co., Limited. She is built of steel and is of the following dimensions:—Length, 248 ft. 9 in.; breadth, 32 ft.; depth, 14 ft. 5 in. It is intended to employ her in the service between Grangemouth and Rotterdam, and for this purpose accommodation has been provided for 48 cabin passengers. Messrs. Martin & Co., Glasgow, have fitted her with electrical appointments, and the engines, made at Lilybank Works, Dundee, are of the triple-expansion type, and have cylinders 21½ in. by 34 in. by 56 in., with a piston stroke of 42 in. The boiler pressure is 170 lbs., and the speed is expected to reach 13 knots. On deck there are three steam cranes and two steam winches, steam steering-gear has been introduced, and the vessel, whose tonnage is 1,050, is fitted with water ballast arrangements.

Angelo and Buffalo.—On January 11th Messrs. Mackie & Thomson launched from their Govan yard two small screw lighters of 120 tons carrying capacity, for Messrs. Andrew Reid & Co., Glasgow. The dimensions are:—Length, 65 ft. 6 in.; beam, 18 ft. 6 in. by 8 ft. deep, and Messrs. Muir & Houston will supply the necessary engine power.

Lytham.—On January 18th Messrs. Murdoch & Murray, Port-Glasgow, launched a twin-screw hopper barge, built to the order of the Lancashire and Yorkshire and London and North Western Railway Co.'s. Her dimensions are:—Length, 125 ft.; breadth, 24 ft.; and depth, 10 ft. The machinery, which is to consist of two sets of patent triple-expansion surface-condensing engines, with cylinders 9 in., 18 in., 32 in. by 22 in. stroke, with a steam pressure of 160 lbs., is to be constructed by Messrs. Rankin & Blackmore, Greenock.

Carnarvon Bay.—On January 19th there was launched from the shipbuilding yard of Messrs. Anderson, Rodger & Co. a full-rigged sailing ship of 1,800 tons register, to carry 3,200 tons deadweight. Her dimensions are:—265 ft. by 40 ft. by 23 ft. She is built to the order of Messrs. Roberts, Owen & Co., Liverpool, and a special feature about the vessel is her completely laid 'tween decks and her splendid outfit of modern appliances for the expeditious discharge and handling of cargo. As the vessel left the ways she was gracefully christened *Carnarvon Bay* by Miss Rodger, of Glenpark. The new ship will mast and fit out generally at Port-Glasgow Harbour.

Surprise.—On Saturday, January 20th, the Montrose Shipbuilding and Engineering Co. launched a powerful steel screw tug 69 ft. B.P. by 16 ft. 3 in. by 8 ft. 2 in. hold, built to the order of Mr. Joseph Constant, London. This vessel, which is the first of three this company are building for the same owners, is built of steel under special survey, and her scantlings are much in excess of Lloyd's requirements. She will be fitted

by Messrs. Gourlay Brothers & Co., Dundee, with C.S.C. engines 14 in., 28 in. and 22 in. stroke, with boiler 10 ft., by 9 ft., and 120lb. pressure. She will have Fisher's of Paisley midship steering gear, and powerful lever windlass, company's own make, will be fitted forward on deck. Cabins are tastefully fitted up in pine having swing lamps, brass hand-rail, water-line w.c., washstand and usual accessories. The vessel was gracefully christened *Surprise* by Miss Margery Lyell, daughter of A. Lyell, Esq., of Gordyne. The hull and engines have been built under the personal supervision of Mr. Walter Pollock, London. The Montrose Shipbuilding Co. have just concluded a contract with Messrs. Harries, Brothers & Co., shipowners, Swansea, for a 650 ton D.W. steel screw steamer to be fitted by Gourlay Bros. & Co., Dundee, with C.S.C. engines 22 in., 44 in., by 30 in., stroke, with boiler 13 ft. 6 in. by 10 ft. and 120 lbs. pressure, and will be fitted with all the most modern improvements. The yard is a scene of great activity, there being nine vessels in course of construction, and as soon as the vessel is launched another keel takes its place.

Aco.—On January 23rd Messrs David J. Dunlop & Co., engineers and shipbuilders, Inch Works, Port-Glasgow, launched from their works the s.s. *Aco*, built by them to the order of the American Cotton Oil Co., Limited, of New York. The general particulars of the steamer are as follows:—Length on load waterline, 333 ft.; breadth moulded, 43 ft.; and depth moulded to spar deck, 22 ft. 9 in.; the vessel's gross tonnage being about 3,500 tons. The *Aco* has been specially designed by her builders for the particular trade in which she is to be employed, viz.: that of carrying a varying cargo of cotton seed and cotton seed cake or meal, in eight thwartship holds, a divisional centre line watertight bulkhead being extended to the height of spar deck, the total deadweight carrying capacity, including bunker coal, being 4,800 tons. The various holds throughout the vessel were tested in presence of Lloyd's and Bureau Veritas principal surveyors together with the company's resident surveyor, Mr. George, and notwithstanding the severe pressure the separate bulkheads had to be subjected to, the most satisfactory results were obtained. The *Aco* has been built to designs and specifications prepared by the builders and is in every respect similar to the *Lackawanna* and *Delaware*, recently built by them for the Anglo American Oil Co., Limited, only such alterations or deviations being made as were required by the mixed nature of the cargoes the *Aco* has been specially designed to carry. For the purpose of efficiently and expeditiously working all the hatches of the separate holds, special horizontal derrick cranes have been devised by Mr. Dunlop, enabling all to be controlled and wrought easily, and cargo delivered over the side at any desired distance from the different hatches, the motive power for working the cranes being taken from specially adapted steam winches supplied by Clarke, Chapman & Co. The steam steering gear is of Davis latest description, with a screw gear aft by Messrs. Hastie & Co., of Greenock, whilst the windlass is of Clarke, Chapman & Co.'s combined steam capstan type. A complete electric light installation is also being carried out by Messrs. Clarke, Chapman & Co. Every attention has been paid to the accommodation for officers, engineers, and crew, to ensure their comfort, and with all the other appliances has been specially arranged to suit the vessel's trade. Immediately after the launch the vessel was placed under the builders' steam crane to receive her machinery, which is of the three crank triple-expansion type, the cylinders being 25 in., 40½ in., 65 in. diameter, 48 in. stroke, there being two large double-ended steel boilers, constructed for a working pressure of 160 lbs. per square inch. A prominent feature throughout the machinery is the large amount of bearing surface given to all working parts, being from 25 to 50 per cent. in excess of the usual mercantile steamer. The advantage of this has been found in the time saved in overhauling, and consequently the shorter time required in port each trip. On leaving the ways Miss Anderson, Wilton House, Kelvinside, on behalf of Miss Ruth Adams, the daughter of Mr. Adams, president of the company, who was unable to be present, gracefully performed the ceremony of naming the vessel *Aco*.

Tantallon Castle.—On January 23rd the Fairfield Shipbuilding & Engineering Co., Limited, launched from their yard at Govan the *Tantallon Castle*, a handsome screw-steamer, built to the order of Messrs. Donald Currie & Co., for the Castle Co.'s South African Royal Mail service. The vessel is of 5,800 tons gross register, measuring 455 ft. in length over all, ... breadth of 50 ft. 8 in. by 35 ft. deep. She will be rigged with three masts, with yards and foremast, and, unlike the *Dunottar Castle*, will have but one funnel. Built of steel to class 100 A1 at Lloyd's as a spar-deck vessel, she has a continuous cellular double bottom and 10 steel water-tight bulkheads, extending up to the spar deck, in accordance with the recommendations of the Bulkhead Committee. This arrangement will enable the vessel to float with any two compartments flooded. As in the *Dunottar*, special attention has been paid to the passenger accommodation, and the result is calculated to meet the requirements of a first-class mail and passenger service. Messrs. Currie's long experience has enabled them to select everything really conducive to the comfort of passengers, and to make adequate provision for their every want. The 'tween deck space is lofty and spacious, and the public and private rooms are provided with every convenience. The promenade deck, reserved for first-class passengers, extends for almost two-thirds of the vessel's length, and the saloon, which is abaft the engine-room, and extends the full width of the vessel, is seated for 145 passengers. The second-class saloon is forward of the boiler space, and there is accommodation at the tables for 100 persons. The third-class accommodation is still further forward, and is entered from a large house on the upper deck. It will be found much superior to anything yet prepared for this important section of the travelling public. The engines are of the quadruple-expansion type, having four cylinders working on four cranks. They are the largest of this type yet constructed; being of 7,500 H.P. The high-pressure and first intermediate pressure cylinders are each fitted with a piston valve, and the second intermediate and low pressure cylinders with a double posted slide valve, all being worked by the usual double eccentric and link motion valve gear. The reversing gear is controlled by one combined steam and hydraulic direct-acting reversing engine. The crank shaft is in four pieces, each being built, and together with the thrust, tunnel, and propeller shafts, is of Siemen's-Martin mild ingot steel. The screw propeller has four blades of manganese bronze upon a boss of cast steel. The condensing water is circulated by two large centrifugal pumps, driven by independent triple-expansion engines, each pump being capable of supplying sufficient water for the main engines working at full power. Two evaporators, working in combination with two distillers, supply fresh water to the ship and boilers. This arrangement is calculated to supply the greatest amount of fresh water at the smallest expenditure of steam. An auxiliary condenser has in addition been fitted on board with a separate air and circulating pump. The boilers, which are entirely of steel, and adapted for a working pressure of 200 lb. to the square inch, are five in number—three double-ended and two single-ended—and of the ordinary multitubular marine type. Each of the double-ended boilers has six furnaces, and each of the single-ended ones four—26 furnaces in all. The cellular double bottom is arranged for carrying water ballast, and a large double-acting duplex donkey pump is connected with a complete system of piping for filling and emptying the ballast tanks. This may also be used to draw water from the bilges. There is a complete installation of electric light, the current being generated by three dynamos, each driven direct by triple-expansion engines. Electricity is also used for driving ventilating fans, placed where the usual up-and-down draught ventilation requires supplementing. The cabins are supplied with electric call bells. A large refrigerating machine in the engine-room is in communication with suitably insulated cold chambers for the preservation of fresh meat and provisions during the voyage, and also to facilitate the carriage of foreign fruit, a trade which is expanding rapidly. The usual complete outfit in terms of the Act for Preservation of Life at Sea is supplied, in addition to the thousand and one things nowadays demanded by the Board of Trade. There was a large attendance at the launch, the owner's party in the reserved enclosure including many South African men of note. Amongst those present were Lord and Lady Kelvin; Sir Donald Currie, K.C.M.G., M.P.; Lady Currie; Sir Charles Mills, K.C.M.G.; Sir Robert Herbert, G.C.B.; Sir James Marwick; Mr. C. W. Cayzer, M.P.; Mr. Walter Peace, C.M.G.; Mr. Montague White, C.E.; Sir W. G. Pearce, Bart., M.P.; Mr. Richard Barnwell, managing director of the Fairfield Co.; Sir William Arroll; Provost Kirkwood and Mrs. Kirkwood; and Mr. T. J. Dodd, of Lloyd's. The launch took place shortly after two o'clock. Lady Currie performed the christening ceremony, and the vessel left the ways amidst loud cheers. The builders afterwards entertained

the launch party at luncheon in the drawing offices, Sir W. G. Pearce, Bart., M.P., chairman of the Fairfield Co., presiding. The *Tantallon Castle* will leave London on her first voyage to the Cape, *via* Southampton, on May 4th, returning from Cape Town on June 13th.

LAUNCH—Irish.

Torr Head.—On January 20th there was successfully launched from the shipbuilding yard of Messrs. Harland & Wolff, Limited, a fine steel twin-screw steamer named the *Torr Head*, built to the order of the Ulster Steamship Co., Limited, Belfast, Messrs. G. Heyn & Sons, managers. The dimensions of the vessel are:—Length between perpendiculars, 452 ft.; breadth, 50 ft.; depth, 35 ft. 4 in.; about 6,000 tons gross and 3,900 tons net register, and carrying capacity of about 8,500 tons deadweight. The steamer will be classed A1 at Lloyd's, under special survey, with machinery certificate. She is built under the three-decked rule, considerably in excess of Lloyd's requirements; has long forecastle, long bridgehouse amidships, extending from side to side of the vessel, forming a complete protection for engine and boiler casings, and long poop aft; there are six hatchways, with powerful steam winches by Wilson, of Liverpool; Harfield's patent steam windlass and capstan, and Pirrie & Wilson's patent spring tiller and direct steam steering gear. The *Torr Head* is built on the cellular double-bottom principle, having capacity for about 1,400 tons water ballast, with large trimming tank aft fitted for cargo; is fore and aft rigged with four steel pole masts, has two heavy steel decks and bridge deck of steel covered with pine. Saloon accommodation for captain and a few passengers is arranged in large house on forward end of bridge deck, with teak chart-house and wheel-house above on flying bridge. Engineers' and officers' rooms are on after end of bridge. Petty officers are accommodated in forecastle and crew in poop. The steamer will be fitted throughout with a very complete installation of electric light by Messrs. J. H. Holmes & Co., Newcastle-on-Tyne. The engines, which have also been constructed by Messrs. Harland & Wolff, consists of two sets of triple-expansion type, with latest improvements, to indicate about 2,700 H.P. with 180 lbs. working pressure; steel shafting and two manganese bronze propellers. Steam is supplied from four boilers, two of which are double-ended. The *Torr Head* is the largest vessel owned in Ireland, and is a fine specimen of the most modern type of cargo steamer. She will be commanded by Captain Thomas M'Calmont, commodore of the Head Line, who has been connected with the company since its formation. This is the sixth steamer built by Messrs. Harland & Wolff for the Ulster Steamship Co., who now own a fleet of nine high-class cargo steamers, each of which have been built in Belfast.

LAUNCHES—American.

Patrol.—Baltimore police boat was successfully launched from the yard of the Maryland Steel Co. on November 11th, 1893. She is a nicely modelled twin-screw craft, and is designed to develop a speed of 16 miles per hour. Her principal dimensions are:—Length, 143½ ft.; beam, 22 ft.; depth, 10½ ft.; mean draught, 7 ft.

Mohegan.—Wood freight and passenger steamer, built by Mr. G. Lester, of Marine City, for Messrs. Curtis & Brainard, was successfully launched November 14th, 1893. Her dimensions are: Length, of keel, 225 ft.; beam, 39 ft.; depth of hold, 14 ft. She will be fitted with a fore-and-aft compound engine, supplied by Messrs. S. F. Hodge & Co., of Detroit, Michigan.

City of Lowell.—On November 21st there was launched from the yard of the Bath Iron Works of Bath, Maine, U.S.A., the palatial twin-screw steel passenger steamer *City of Lowell*, designed by Mr. A. Cary Smith, for the Norwich and New York Transportation Co. This vessel is intended to excel in power, speed, capacity, and elegance any screw-boat on the American coast, her principal dimensions being:—Length, over all, 336 ft.; length, load water line, 319 ft. 10¼ in.; depth of hold, 17 ft. 5 in.; extreme breadth, 66 ft. 1 in.; beam, moulded, 49 ft. 6½ in.; load draught, 13 ft.; displacement, about 2,500 tons; speed, 20 knots. She has five decks, named respectively, lower, main, saloon, gallery, and hurricane. The lower decks, forward and aft, are devoted entirely to the crew and free berth passenger accommodation, there being 90 free berths forward and 102 aft, whilst forward of all 63 berths are fitted for the crew, table waiters, &c. About 200 ft. of the main-deck amidships is devoted exclusively to freight, and is entirely separated from the living spaces in all respects. On the after part of this deck is a commodious social hall, just aft of which is the ladies' cabin. At the forward end of the main deck the "Hyde" patent steam windlass and the "William" steam steerer is placed, also the mess-rooms for the crew, firemen, &c. The saloon deck is devoted entirely to the accommodation of passengers, there being 81 double-berth state-rooms, and 25 rooms with brass bedsteads on this deck. The dining-room, kitchen, officers' quarters, and *café*, or smoking-room, are on the gallery deck; also 35 double-berth state-rooms. The machinery will consist of two independent sets of vertical inverted direct acting, triple-expansion engines, driving twin screws, the cylinders being 26 in., 40 in., and 64 in. diameter respectively, with a piston stroke of 36 ins. The collective I.H.P. is estimated at 4,600, when the engines are making 125 revolutions, a piston speed of about 750 ft. Steam will be supplied by six steel single-ended Scotch return tubular boilers, each having a length of 12 ft. 10 ins., and a diameter of 13 ft. 6 ins. They are each fitted with three corrugated furnaces of 43 in. diameter, and are designed for a working pressure of 165 lbs. She is to be fitted with See's patent hydraulic ash ejector, and with Worthington pumps throughout. The vessel is expected to go on the New York and New London route early in June.

Orinoco.—Built by McEntree & Rodie, of Kingston, N.J., for Shebaud Bros., successfully launched November 22nd. She is a small twin-screw schooner, and is intended for service on the Amazon River. Length, 70 ft.; beam, 15 ft.; depth. 8 ft.; tonnage, 56 tons.

Bangor.—A fine wood side-wheel passenger steamer, built for the Boston and Bangor Steamship Co., was launched early in November from the yard of Mr. McKie, East Boston, Mass., U.S.A. Her principal dimensions are:—Length, over all, 280 ft.; keel, 266 ft.; extreme beam, 66 ft.; beam, 38 ft.; depth, 14½ ft.; displacement, 1,600 tons. The machinery is to be built by Messrs. W. & A. Fletcher & Co., of Hoboken, N.J., and the contract calls for a speed of not less than 18 miles per hour.

TRIAL TRIPS.

Netherlands.—This large ferry boat, built for the Hoboken Ferry Co. by T. S. Marvel & Co., of Newbury, had a successful trial on November 13th. She is 209 ft. long, 62 ft. extreme beam, 42 ft. moulded beam, and 17 ft. deep, and with 1,100 H.P., a speed of 12 knots was easily obtained.

Gloucester.—This handsome steel passenger steamer, built by the Maryland Steel Co. for the Merchants' and Miners' Line of Boston, had a successful trial on the Chesapeake early in November. Her dimensions are:—Length over all, 293 ft.; beam, 42 ft.; depth, 33·2 ft. She has four decks, and is remarkable for her great depth. The machinery consists of a triple-expansion engine, the cylinders having a diameter of 28 in., 45 in., and 72 in. respectively, with a common piston stroke of 48 in.; the propeller has a diameter of 16 ft. Four boilers are fitted, they having each a diameter of 13 ft. 9 in., and a length of 11 ft. 6 in. The total grate surface in twelve 45 in. furnaces is 292 square feet. The trial was very successful, and with 76 revolutions per minute the engines developed 2,381 I.H.P., with a corresponding speed of 15 knots.

Snowflake.—On December 19th the steel screw tanker *Snowflake* was taken to sea for her trial trip. The vessel has been built at the Walker yard of Sir W. G. Armstrong, Mitchell & Co., for the Bear Creek Oil and Shipping Co., of which Messrs. C. T. Bowring & Co. are the managing owners. The vessel has been constructed on Swan's patent system for the carriage of petroleum in bulk, and she has taken the highest classification at Lloyd's Registry for such vessels. Her principal dimensions are:—Length, 305 ft.; breadth, 39 ft. 6 in.; depth, 27 ft. 9 in. She is capable of carrying about 4,000 tons deadweight. The propelling machinery is on the triple-expansion system, manufactured by the Wallsend Slipway and Engineering Co. Owing

to the rough state of the sea, no speed runs were made on the measured mile, but during the few hours the vessel was on trial the machinery gave every satisfaction. Immediately after the trial trip the *Snowflake* proceeded on her maiden voyage to America.

Pacific.—On January 15th the steel screw steamer *Pacific*, which has been built by Messrs. W. Gray & Co., Limited, of West Hartlepool, for Messrs. W. H. Cockerline and Co., of Hull, went on her trial trip. Her dimensions are:—Length over all, 310 ft.; breadth, 42 ft., and depth, 20 ft. 10 in. The deck erections consist of a poop, raised quarter-deck and partial awning deck. The saloon and cabin are aft, the engineers' rooms in the after part of the awning deck, and the crew's accommodation forward. The hull has been built on the web-frame system, with cellular double-bottom throughout. Large hatchways have been fitted, four steam winches, steam steering gear amidships, screw gear aft, large patent donkey boiler, patent direct steam windlass, shifting boards throughout, and boats on beams overhead. Two masts with schooner rig and all modern working appliances have been fitted for general trading. The vessel takes Lloyd's highest class. The Central Marine Engine Works of Wm. Gray & Co., Limited, have supplied the engines, which are of the triple-expansion type, having cylinders 24 in. 38 in., and 64 in. diameter, with a stroke of 42 in. and two large steel boilers to work at a pressure of 150 lbs. per square inch. The vessel and machinery have been built under the personal superintendence of Mr. Strong, of Messrs. J. Jamieson & Co., Hull, on behalf of the owners. The *Pacific* left the port of the Hartlepools early in the morning, the weather being calm and the sea smooth. For a couple of hours the engines were run at an easy speed to accommodate the wishes of the compass adjusters, Messrs. Berry & Co., of West Hartlepool, this operation being completed before 10 o'clock. About that hour the vessel returned to the Bay to meet a tug boat, which brought off a party of those interested in the vessel, including the managing owner, Mr. W. H. Cockerline, of Hull, Mr. J. Penn, of Cardiff, Mr. J. Murrell, of Messrs. Wm. Gray & Co., etc. The engines were then started full speed ahead and the vessel headed southward, returning to Hartlepool about three o'clock. The propeller was not fully immersed, and the engines were throttled to a speed of 72 revolutions per minute, the vessel making 12 knots per hour. There was an abundance of steam during the whole trial, and the tall funnel provided in this ship gave an exceedingly strong draught and very free burning fires. The vessel has not only the latest improvements on the Central Marine type of engines themselves, but it is also fitted with Mudd's patent evaporater for supplying fresh water feed to boilers. The auxiliary feed pump is of the Worthington type, and the ballast donkey is made capable of driving also the turning gear. The tail shaft is protected from the destructive galvanic and corrosive action which has long been so detrimental to the life of tail shafts, under a recent patent taken out by Mr. Mudd, and which consists of securing the shaft where it is exposed to this destructive action in an elastic sleeve. The vessel is also provided with a spare tail shaft prepared ready to receive a sleeve when required, and with a spare crank shaft. The indicator diagrams taken from the engines on the trial were of a highly satisfactory character, and there can be no doubt that Messrs. Cockerline & Co. are now possessed of one of the most economical and efficient cargo steamers afloat. At the luncheon, which was provided on board, Mr. Mudd, who represented the engine builders, proposed "Success to the *Pacific*," which was duly responded to by Mr. Cockerline. Mr. Murrell proposed the health of Capt. Marshall, who suitably responded. The vessel left at about half past three o'clock for Cardiff, where she will load for the River Plate.

Ardanrose.—On January 16th the screw steamer *Ardanrose* proceeded down Belfast Lough on her trial trip. The vessel has been built to the order of Messrs. Clark & Service, of Glasgow, for the Ardan Steamship Co., Limited, and is a sister ship to the *Ardandhu*, lately completed by the same builders. The principal dimensions are:—Length, 281 ft.; breadth, 39 ft. 6 in.; depth moulded, 25 ft. 4 in.; gross tonnage, 2,130 tons. She has been built to Lloyd's 100 A1 class, and to the British standard class, and has two steel decks, the spar being also sheathed with teak, each of the four cargo holds is fully equipped with double derricks and winches. The bridge is fitted up for captain, officers, and engineers. The forecastle contains accommodation for the crew. A poop aft contains the wheelhouse, and can be used for cargo. The *Ardanrose* is schooner rigged, with telescopic masts, suitable for the Manchester Canal. The machinery has been constructed at Messrs. Workman, Clark & Co.'s Engine Works, Queen's Road, and consists of triple-expansion engines and two steel boilers working at a pressure of 180 lbs. These boilers are fitted with Howden's system of forced draught. After running the measured mile, on which an average speed of 13¼ knots was attained, the *Ardanrose* cruised about the Lough for some time, and afterwards proceeded on her way to Ardrossan to load cargo.

Vala.—On January 17th the new steel screw steamer *Vala*, just completed by Messrs. Ramage & Ferguson, Limited, Leith, for Messrs. J. T. Salvesen & Co., Grangemouth, went on her trial trip on the Firth of Forth. The principal dimensions of this steamer are:—Length between perpendiculars, 216 ft.; breadth, extreme, 32 ft.; depth, moulded 16 ft. 3½ in., while her machinery consists of a pair of high-pressure two-cylinder engines, 21 in. and 45 in. diameter by 33 in. stroke, working at a pressure of 120 lbs. A large party joined the ship in the roads and on their way down the firth to the measured mile they had an opportunity of thoroughly examining the steamer and her machinery, which worked without a hitch. At Gullane a trial of speed was made showing a mean result of 11·758 knots per hour was made. This speed was considerably over what was anticipated, and the excellent results were considered due to the propeller, which was specially designed by Mr. Henry Adolph Salvesen, the managing owner, and cast from Bull's special bronze by the Phosphor Bronze Co., of London.

Malleco.—On January 20th the steel twin-screw steamer *Malleco*, the second of two built by Messrs. R. Napier & Sons for the Compania Sud Americana de Vapores, Valparaiso, had a very successful trial on the Firth of Clyde, when the conditions of the contract were fully implemented. These vessels have been built to the instructions of Mr. Thomas Dewsbury, and specially designed to meet the requirements of the company's Pacific coasting trade, carrying a large cargo on a light draught of water, with comfortable accommodation for passengers amidships. As they are intended for service in a hot climate, the saloon and state-rooms have been placed on the main deck, where good ventilation can be obtained, with a teak awning deck fore and aft, and all the most modern fittings for the efficient working of the steamer, and the rapid handling of cargo. The machinery consists of two sets of triple-expansion engines driving twin screws, and a single-ended boiler for a working pressure of 150 lbs., with all the most recent improvements for economy. After a most satisfactory trial the steamer returned to Glasgow to load for the voyage to Valparaiso, under the command of Captain W. Cockbain.

Lindenfels.—On January 22nd the steamship *Lindenfels* left the Cleveland Dockyard of Sir Raylton Dixon & Co., Middlesborough, for her official trial trip. This vessel has been built to the order of Messrs. the Hansa Steamship Co., of Bremen, and is the third steamer completed for this company by the same builders. She is of the spar deck type, and takes Lloyd's highest class, the spar deck being of steel sheathed with teak; the main deck is of steel, and the poop, bridge, and forecastle decks are of teak. Handsome accommodation is provided for the captain, officers, engineers, and a few passengers. The principal dimensions of the steamer are:—Length, 327 ft.; beam, 41 ft. 9 in.; depth moulded, 28 ft. 6 in.; and she has a deadweight carrying capacity of 4,500 tons, with every modern improvement for rapid loading and discharging. The fitting out of the vessel has been under the superintendence of Captain Erich Groot, who will take command. The engines have been supplied by Messrs. Thomas Richardson & Sons, of Hartlepool, the cylinders being 24 in., 38 in., and 64 by 42 in., with two large steel boilers working at a pressure of 160 lbs. per square inch, and these have been constructed to fulfil the requirements of the German Government as well as Lloyd's regulations. During the trials the main engines and general machinery worked with the greatest satisfaction, and the steamer afterwards returned to Middlesborough Dock to load.

Aeolus.—The s.s. *Aeolus* has lately been sent to sea from the Tyne on her loaded trial trip, and proceeded on her first voyage to Bombay. This vessel was built by Messrs. C. S. Swan & Hunter, of Wallsend-on-Tyne, and engined at the Central Engine Works, West Hartlepool. She is owned by Messrs. Rickinson, Son & Co., also of West Hartlepool, and is the fifth steamer belonging to the same owners having Central Marine Engine Works' engines. The *Aeolus* is a large vessel, 318 ft. in length, 41 ft. beam, and 23 ft. 1½ in. moulded depth. She will

carry about 4,400 tons deadweight, and will be engaged in general trading. On the trial trip the engines worked perfectly there not being the slighest hitch of any kind, and as the vessel was fully loaded the trial was of more importance than the usual light-ship trial, which alone is to be had as a rule in new vessels leaving north-east ports. The log was thrown overboard, and with the engines running about 62 revolutions per minute, the speed of the vessel was ascertained to be 9½ knots, which was regarded as eminently satisfactory with a deep loaded ship.

Blackpool.—In the middle of last month the twin screw steamer *Blackpool* was fully loaded with dredged materials for the purposes of trial, and as a mean of four runs on the mile at Skelmorlie a speed of over nine knots was attained. This vessel, which was built by Messrs. Murdoch & Murray, Port Glasgow, and engined by the contractors, Messrs. Rankin & Blackmore, Greenock, has been constructed to the order of the Lancashire & Yorkshire and London & North Western Railway Co.'s. The leading dimensions are:—Length, 130 ft.; breadth, 24 ft.; and depth of hold, 9 ft. 6 in.; and the hoppers have a carrying capacity of fully 300 tons. These latter are of the most modern construction, and a special arrangement of chains and screws on the sides of the compartment takes the place of the usual hopper-beam. The doors are wrought by suitable crab winches. The vessel is built of steel, and is divided into five watertight sections by bulkheads. A poop is placed aft with substantial erections over the engines and boilers, affording excellent protection in heavy weather. Accommodation, suitably furnished, has been provided forward for the captain, engineers, and crew. Towing gear has been fitted, and a substantial elm fender extends all round the vessel. The machinery consists of a set of Rankin's patent disconnecting triple-expansion, twin-screw engines, with four cylinders, 9 in., 9 in., 18 in., and 32 in. diameter by 22 in. stroke, working tandem. The owners specified these engines on account of their extreme simplicity as compared with the ordinary triple-expansion twin-screw type. The propellers are arranged on the firm's well known overlapping system, and the facilities which twin screws offer in going alongside and leaving the dredgers are thus not attended by risk of the blades doing any injury. Steam has been supplied at 150 lb. pressure, and a Williamson's patent feed heater and filter has been provided. This invention was found to work very efficiently in the removal of objectionable deposits and in heating the feed water. The deck appliances include a strong steam winch, and a windlass for working the anchors. Chadburn's engine room telegraphs, supplemented by speaking tubes, have been erected on the bridge. The vessel was built under the supervision, as to design and construction, of Mr. A. T. Gibson and Mr. G. P. Muloch, engineers of the company, and their assistants, Captain Bond and Mr. Hayes. Much satisfaction was expressed at the successful accomplishment of the owners' requirements.

Jamesia.—The steam fishing vessel *Jamesia*, the latest addition to the Grimsby fleet of trawlers, has lately been on her trial trip. The vessel has been built by Messrs. Cochrane & Cooper, Beverley, to the order of the North-Eastern Fishing Co., of Grimsby, and is fitted with a well for carrying live fish; and Messrs. C. D. Holmes & Co. have fitted into her triple-expansion engines of 50 N.H.P., a large boiler, and their special winch, all of the latest and most approved type. The *Jamesia* left the Hull docks at nine o'clock, and steamed down the Humber to Grimsby, where a large party of those interested in the company were taken on board. She then proceeded on her trial, the result showing 10¾ knots. During the whole of the trial the machinery worked without the slightest hitch, and to the entire satisfaction of the owners' representative, Mr. Fisher. Mr. J. R. Smith represented the engineers, and Mr. Cochrane the shipbuilders.

U.S. Marblehead.—This U.S. second-class protected cruiser, built by Messrs. Hanson, Loring & Co., of Boston, had a successful trial last month, when, with 6,000 I.H.P. a speed of 18·44 knots was obtained, as a result of four hours' run, with forced draught, on Long Island Sound. Her dimensions are: Length (L.W.L.), 257 ft.; beam, 37 ft.; draught, 14½ ft.; displacement, 2,050 tons. The main armament consists of eight 5 in. and two 6 in. rapid-firing breech-loading rifles. The contract price of the vessel was 930,000 dols. and the builders earn 125,000 dols. for their extra speed premium.

Columbia.—The U.S. commerce destroyer *Columbia*, built by Wm. Cramp & Sons, of Philadelphia, had a successful trial off the Maine coast last month, when with 22,000 I.H.P. a speed of 22·81 knots was obtained as the result of a four hours' continuous run at full speed. A novel feature in this vessel is the triple-screws. Her principal dimensions are:—Length, 412 ft.; beam, 58 ft.; draught, 23½ ft.; displacement, 7,350 tons. Her main armament consists of one 8 in. and two 6 in. B.L.R. and eight 4 in. rapid-firing guns. Her coal capacity is 2,000 tons, and this at 10 knots speed will give her a radius of action of 25,400 miles. The vessel can be propelled by one, two, or three screws, and on her recent trial with two screws a speed of 19 knots was obtained. The contract price for hull and machinery was 3,250,000 dols., and the builders earn 350,000 dols. for their extra speed premium.

Marienburg.—On January 18th, the s.s. *Marienburg*, built for the Bremer Hansa Steamship Co., by the Flensburg Shipbuilding Co., made her first trial trip. She has the following dimensions: 292 ft. by 39 ft. 8 ins. by 25 ft. 2 in., and with the triple-expansion engines of 1,200 H.P., she got an average speed of 11¾ knots, by a very moderate coal consumption. After the trial, in which the directors partook, the steamer left for Bremerhaven.

Reviews.

A Pocket Book of Marine Engineering; Rules and Tables. By A. E. Seaton, and H. M. Roundthwaite. London: Charles Griffin & Co., Limited. 1894.

This little volume is written by two gentlemen who are known to the public as engineers and naval architects of experience. The former has already been before our readers as a writer on subjects akin to those within the scope of the present volume. In the preface it is remarked that amongst the numerous works of the pocket book class, there is as yet not one written specially for the use of the marine engineer, and, having discovered a want, our authors hasten to supply it. They seem to have well realised the needs in this direction, and to have supplied them, skilfully. The book has a good index and plenty of diagrams, which are both necessities of the first importance in works of this class. The rules and tables are very comprehensive. They relate to H.P. and efficiency of engines, and to the strength, form, and weight, of all the various parts of marine engines of every type now met with, and of every class, whether naval or commercial. Weights of engines as usually allowed to merchantmen, mail boats, and men-of-war, from the battleship down to the torpedo boat, are to be found here. Lloyd's and the Admiralty rules on all subjects connected with the naval architect's and marine engineer's work are embodied in the volume. Comparisons of the efficiency of various types of engine are made, and the form and design of boilers, screws and paddle-wheels are gone into. There is a good deal of information, not we think usually accessible, relating to the performances and design of the famous little craft turned out at Poplar and Chiswick, by Messrs. Yarrow & Thorneycroft, respectively. Generally we think the book fulfils its purpose admirably, and that those for whom it is intended will find the advantage of it, for it gives information not found in more general works of the class, and that in place of other matter which, if always interesting, is not often necessary to the marine engineer when away from a library or study.

Helical Gears: A Practical Treatise. By a Foreman Pattern-Maker. London: Whittaker & Co. 1893.

This is by no means the first occasion on which we have directed our readers' attention to the contributions of the "Foreman Patern-maker" to the valuable list of books on art and science published by Messrs. Whittaker. The author notices in his practice that helical gears are often, we might almost say, generally, constructed on unscientific methods. This is perhaps not altogether to be wondered at, for the pattern-maker, and his near kinsman the moulder, go to work on a somewhat empirical plan, and as long as they do their work fairly they receive little interference from the scientific branch of the profession. Yet, as is clearly explained to us here, and as indeed would be obvious to anyone on a little consideration, the forces at work in the movement of the simplest gearing are of a very complicated

character. Without some knowledge of them and consideration of their action, it is impossible for gearing to be designed which shall give the maximum efficiency for the minimum of weight. The strength and weight of material may be put in the wrong places and the bearings surfaces may not be designed so as to give the best account of themselves. In his treatment of this subject the Foreman Pattern-maker, who gives us no clue to his identity beyond the initials J. H., with which he signs the preface—displays his usual lucidity of arrangement of matter and clearness of style. The work is thickly interspersed with diagrams, and he points out with due iteration and insistance that unless helical gearing be correctly designed and perfectly carried out in manufacture, it is less advantageous than the ordinary gearing. If, however, it be executed properly there is great economy of power. The diagonal thrust, which is not merely waste of power, but is actually power misapplied, is minimized, and the friction, which is a certain waste of energy, is also lessened. These advantages are to be won by a slight increase in cost of production and a careful attention to the rules laid down in this work. To pattern-makers, ironfounders, and engineers generally, we can recommend the perusal of the book. Not only those who make, but those who run machinery of this class must study its peculiarities, for a very slight variation by a wheel from its correct position on its shafting will go far to spoil the working of this gear.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

CHURCH'S IMPROVED DESIGN OF STEAM ENGINE.

To the Editor of The Marine Engineer.

Sir,—I have carefully read the description of the above engine in your issue of January, and I must confess that I am quite at a loss to understand for what purpose it has been designed. I would therefore be glad to know—

1. In what manner this engine is better than the ordinary engine with the cylinders either tandem or side by side on two cranks?

2. Why is there so much complication about the crossheads to arrive at a result easily attained in another manner?

3. If it is necessary to provide for the expansion of the cylinders centre from centre, why is there no adjustment provided for the slide rods?

If Mr. Church will supply us with the information asked in the above questions he will confer a favour on us all, especially

Yours, &c.,

"Nauticus."

January 9th, 1894.

TWIN SCREWS.

To the Editor of The Marine Engineer.

Dear Sir,—In your issue of the 1st December a letter was published from Mr. J. B., of Bergen, raising the question, in which direction should the propellers of a twin-screw steamer revolve.

The general custom is to make the screws turn inwards. (Fig. 1). By doing so the strain on the crosshead and slides is a pressure against the columns, and the bolts very slightly strained. This arrangement allows the side of the engine towards the centre line to be fitted with wrought iron pillars without crosshead guides, which makes the moving parts more easily accessible and the starting gear of both engines can be controlled from the same platform. Those are probably the only reasons considered in fitting twin screws, it being usually accepted as a matter of indifference whether a screw is right or left handed. It may also be said that the revolving of the propeller tends to draw the surface water down the side of the ship and thus reduce

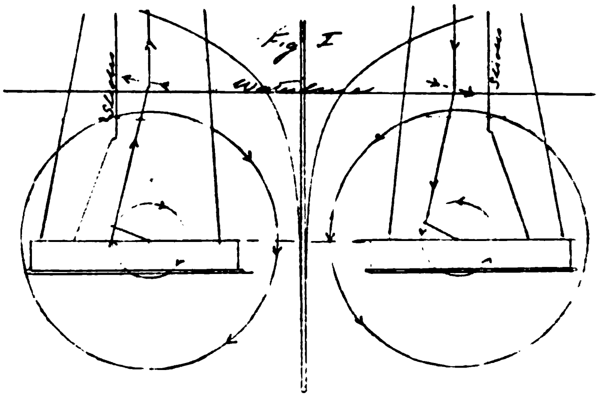


Fig. 2.

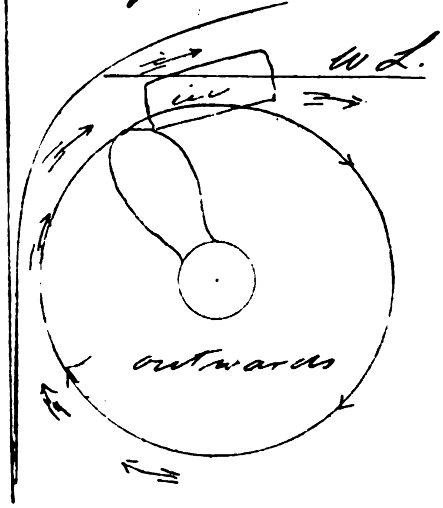
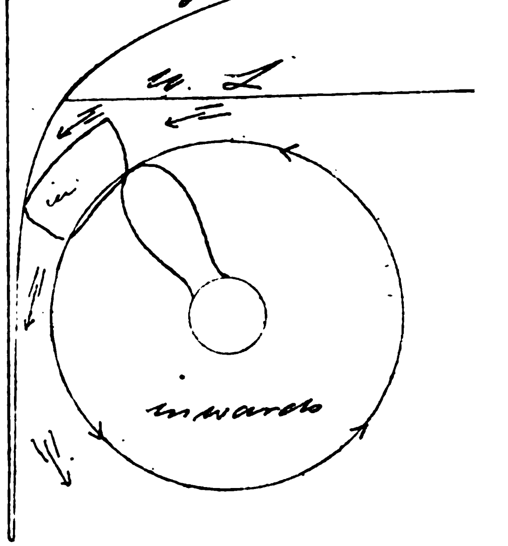


Fig 3.



the stern wave. Some builders prefer, however, to make the propellers revolve outwards, a system which I am rather inclined to support, although the difference in actual advantage is small. For instance, if the vessel has to make her way through in a floating wreckage, the blades are not so easily damaged. By running the screws inwards the in would be drawn down between the blades and the hull or sternpost, and more than likely cause damage of some sort. While by the outward motion the in would be driven into the air or water, where it would be free to get clear of the screw. In the same way the screw, when running outwards, works more in solid water, and what broken water there is, is stiffened by being driven against the ship's side, and from the larger into the smaller space; the most of the churned water being thrown off in the stern wave. In turning the screws inward the broken water from the water line is carried the whole way down to the keel. It may be said that the outward motion increases the stern wave, and consequently the wetted surface. This is true, but the motion of the wave would be quickened, and therefore the disadvantage would not be so great.

It would be interesting and instructive to hear the opinion of more experienced gentlemen on the subject.

Yours truly,

ALEX. MURRAY,

Naval Architect.

Bremerhaven, January 6th, 1894.

Miscellaneous.

Marine Engineers Examination.—At the Board of Trade Examination held at Sunderland on the 9th, 10th, and 11th Jan., Mr. Geo. Tulip succeeded in passing his examination for Extra First-class Engineer. He was prepared by Mr. W. H. Thorn, 5. Waterville Terrace, North Shields, and is the 23rd successful candidate for this certificate from the above establishment.

Contract.—The Campbeltown Shipbuilding Co., Campbeltown (Clyde), have contracted with the General Steam Navigation Co., London, for a screw steamer to carry 2,800 tons.

Machinery for H.M.S. "Swordfish."—We understand that Messrs. G. E. Belliss & Co., of Birmingham, are supplying the machinery for H.M.S. *Swordfish* (torpedo-boat destroyer), to the order of Sir W. G. Armstrong, Mitchell & Co., Limited.

H.M.S. "Hornet," which is the sister vessel to the *Havock*, was safely launched from the works of Messrs. Yarrow & Co., of Poplar, on Saturday, Dec. 23rd.

Catalogue.—Messrs. John Spencer & Co., of the Globe Works, Wednesbury, send us a price list of what they somewhat erroneously term "iron and steel tubes." It is true the list contains tubes, and tubes of all sorts, shapes and sizes. The mining and drainage engineer, the well sinker, the electric cable engineer, the prospector for mineral oil, can all rely on finding all things of this description here. But Messrs. Spencer go further than they profess. Fencing, save by being hollow, and so saving weight and cost, has little right to call itself tubing. Valve boxes, cocks, pumps, and cisterns are all found here, as well as tube-vices, pipe-tongs, and such complicated apparatus as hand-power tube-screwing machines. The firm's make of the latter from the cut seem simple and ingenious machines. The book is thoroughly illustrated, and prices and sizes stocked are to be found at a glance. Perhaps to the Marine Engineer the boiler tubes and accessories at page 4 and following pages will be of the greatest interest.

Rewards for Meritorious Discoveries and Inventions.—The attention of ingenious men and women is hereby directed to the fact that the Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts may grant, or recommend the grant of, certain medals for meritorious discoveries and inventions which contribute to the promotion of the arts and manufactures. The character and conditions of these awards are briefly stated in the following:—The Elliott Cresson Medal, founded in 1848 by the gift of the late Elliott Cresson. This medal is of gold, and by the terms of the deed of trust may be granted for some discovery in the arts and sciences, or for the invention or improvement of some useful machine, or for some new process, or combination of materials in manufactures, or for ingenuity, skill, or perfection in workmanship. The John Scott Legacy Premium and Medal (twenty dollars and a medal of bronze), awarded by the City of Philadelphia. This medal was founded in 1816 by John Scott, a merchant of Edinburgh, Scotland, who bequeathed to the City of Philadelphia a considerable sum of money, the interest of which should be devoted to rewarding ingenious men and women who make useful inventions. The premium is not to exceed twenty dollars, and the medal is to be of copper, and inscribed "To the most deserving." The control of the Scott Legacy Premium and Medal (by Act of the Ordinance of Councils in 1869) passed to the Board of Directors of City Trusts, and has been referred by the Board to its Committee on Minor Trusts, and that Committee has resolved that it will receive favourably the name of any person whom the Franklin Institute may from time to time report to the Committee on Minor Trusts as worthy to receive the Scott Legacy Premium and Medal. The Edward Longstreth Medal of Merit, founded in 1889, by Edward Longstreth, machinist, and late member of the Baldwin Locomotive Works. This medal is of silver, and may be awarded for useful invention, important discovery, and meritorious work in, or contributions to, science or the industrial arts. Full directions as to the manner and form in which applications for the investigation of inventions and discoveries should properly be made will be sent to interested parties on application to William H. Wahl, Secretary, Franklin Institute, Philadelphia, Pa., U.S.A.

Large Dredger for the Danube.—Wm. Simons & Co., of Renfrew, have just received an order from the European Danube Commission for the construction of a 1,250-ton stern well hopper dredger. It is to be employed deepening the Danube. The buckets of the dredger will be of very large size. Besides the buckets it will be provided with powerful sand pumping appliances to operate on the Sulina bar. The construction of the dredger will be under the direction of Sir Charles Hartley, K.C.M.G., the Consulting Engineer to the Commission, and Mr. Wilson Wingate, C.E., London, Inspecting Engineer. When completed this bucket hopper dredger will be the largest and most powerful afloat.

Magnolia Metal.—Amongst the calendars we have received this month we must especially notice that of the Magnolia Metal Co. It is printed in striking but harmonious colours, and in the design the magnolia flower, which gives it its distinctive appellation, is very artistically prominent. The four illustrations combined in the sheet happily illustrate its various uses. The first is a sketch of H.M.S. *Hawke*, one of the first-class cruisers added to the Navy under the Naval Defence Act, 1889. Here we are pleasantly reminded of its use for ship's purposes, with especial reference to the fact that the Admiralty is one of the company's best customers. In the next picture a North-Western Co.'s train is seen running at full speed to tell us that the premier railway company has found "nothing like it." Thirdly, we see an engineer's shop where all the various processes of manufacture are being carried on. This is a hint of its use in every description of machinery. Lastly, we have a picture of a wharf with a cargo steamer lying alongside, which, perhaps somewhat allegorically, tends to show the large export trade done in this useful alloy. Good wine may need no bush, but no one will think any the worse of an article because they see a cleverly-designed almanac when they look up to find out "what day of the month it is."

Development of Steam Navigation.—On Wednesday evening, January 17th, a lecture was delivered at St. George's Vestry Hall, Bloomsbury, on the subject of the Development of Steam Navigation. The lecture, which was illustrated by magic lantern slides, was delivered by Mr. B. W. Ginsburg, M.A., Barrister-at-law. The lecturer devoted his attention to the ocean part of the question, leaving river and channel steamers altogether on one side. Beginning with the early steamers (some views of which were shown) he followed the rivalry of Cunard's and Collins' down to the extinction of the latter. The more recent record holders on the Atlantic were dwelt upon, but the Eastern, Australian, and Cape lines were not forgotten. Many capital views of the interiors of the new Cunarders and White Star steamers were shown, some being illustrative of the fact that if the accommodation of saloon passengers has grown in half a century from a position of some slight discomfort to one of almost unnecessary luxury, that of the steerage passengers has been created, and become very comfortable and healthy. It is only within the last 43 years that steerage passengers have had the opportunity of travelling by steamers at all. Several

diagrams and tables of dimensions were thrown on the screen as well as plans of various types of engines. The lecture, which contained some anecdotes of famous captains, was received with marked interest and at the conclusion a vote of thanks was heartily accorded to Mr. Ginsburg.

Steamer Sails Without Firemen.—The large screw steamer *Baku Standard*, of London, signed articles at the South Shields Shipping Office on Thursday, January 18th, on a voyage to Philadelphia, to engage in the oil trade. No firemen were signed on, their services on board this vessel being absolutely dispensed with, in consequence of new furnaces being fitted in the vessel, by which the boilers are worked with steam jets of oil, &c., they only requiring a watchman to attend upon the jets. This is entirely a new departure, and has occasioned considerable excitement among firemen.

Patent Bucket Fire-Extinguisher.—The highest and only award in British exhibits of fire appliances at the Chicago Exhibition was gained by Messrs. Messer & Thorpe, for their Patent Bucket Fire-Extinguisher, which consists of a number of buckets telescoped into one another and standing in a tank of water of such capacity that on lifting each bucket up from the tank it is filled with water. It will, therefore, be seen that it is a most simple, expeditious, and compact apparatus, requiring little or no attention, being always in readiness, and having no parts of a nature to get out of order. An air-tight lid is fitted to the tank, the water being protected from the atmosphere it does not become impure, and we understand that water that has been in the tanks for over eighteen months has not become offensive in any way. It has been found by long experience, that the most effective means of extinguishing a fire, is to dash at it instantly a considerable quantity of water, and it is this that makes the bucket of water so powerful in grappling with an outbreak of fire. It may be added that in the Corn Mill Tariff of 1892 the only fire appliance that was made compulsory was "six buckets of water on each floor," which speaks volumes for the bucket of water.

Silvinite.—A new metal product is being put upon the market under the title of "Silvinite." It is, we understand, an alloy of aluminium, and can be produced at 2s. 6d. per lb. From the information we have received it can be rolled, drawn, or spun into any section required; further, it can be stamped, forged, or beaten. It is not attacked by acids from organic matter, and hence is useful for domestic, surgical, and other purposes in which such a quality is an advantage. It is particularly applicable for ships' furniture and decorations, as it is not affected by sea-water. Silvinite is a non-magnetic metal, and can be largely used in electrical appliances. As a conductor of electricity silvinite stands high in the list; it has a specific gravity one-quarter that of iron or steel, and in ductility it is seventh in the order of metals after copper

Russian Battleships.—In the spring, the three Russian battleships *Sevastopol* and *Petropanlovsk*, each of 10,960 tons displacement, 10,600 I.H.P., and 17 knots speed, and *Sissori Veliki*, of 8,880 tons displacement, 8,500 H.P., and 16 knots speed, will be launched at St. Petersburg. The two first-named ships will each mount four 12-in., eight 8-in., and twenty-four smaller guns; the third will carry four 12-in., six 6-in., and eighteen minor weapons. Each vessel has a complete water-line belt with a maximum thickness of 16 in.; and the two larger have 10 in., while the smaller has 14 in. armour on the turrets.

Ice-breaking Steamer.—An ice-breaking steamer for the town of Odense has been completed at the Burmeister and Wain shipyard in Copenhagen. The dimensions are:—Length, 70 ft.; breadth 19 ft.; depth in water, without water ballast, 9 ft. aft and 6½ ft. forward. The engine indicates 220 H.P., but can be forced up to 275 H.P. There are two water-tanks aft, from which the water can be led to a water-tank forward, when the steamer is required to break the ice by its weight. The steamer is built to highest class Bureau Veritas. The cost is £3,750. It is fitted with a powerful electric projector. At a trial trip the steamer easily broke 5 in. ice at half-speed.

Torpedo Boats in the United States Navy.—The Navy Department will soon have ready plans for the new 800 ton torpedo cruiser, which the Secretary proposes to construct if shipbuilders are willing to bid on her within the appropriation of 450,000 dols., made by Congress three years ago. An attempt was made to build the boat at the time; but no bids were received on account of the great speed exacted and small chances of premium, and with every indication that the boat would cost more than the appropriation allowed. The Department has been at work again revising the old plans, and endeavouring to reduce the price of the craft. It is believed now that with modifications, which will not affect the value of the boat, that she can be built for the money Congress allowed. The new designs contemplate a boat of 800 tons displacement, 250 ft. in length, 27½ ft. beam, with two decks, part of the cabin on the spar deck, conning tower, but with no turrets or armour. She will have as a battery several 6 in. rifles, a good secondary battery, and five torpedo tubes. She will be required to maintain a speed on her trial of 23 knots an hour, which would place her ahead of any vessel in the navy tried so far. Her engines will be powerful for a vessel of her size, and will be expected to develop 6,000 I.H.P. The stroke of the piston will be 21 in., the revolution of her screws will be 315 per minute, and the steam will come from eight coil boilers, which will be kept going by a total grate surface of 30 square feet.—*U.S. Army and Navy Journal.*

"Patents for Invention."—A paper was read before the Civil and Mechanical Engineers' Society, on Thursday, January 18th, by Mr. E. H. G. Brewster, A.M.I.C.E., chartered patent agent, on "Patents for Inventions." The paper gave a sketch of the origin of these patents and a general history of the subject down to the present time. The author then devoted his attention to the subjects of examination for novelty before a patent is granted, and the policy of reducing or not the fees paid by inventors. With regard to the first of these the writer was not in favour of such examination, for although at first sight it did not appear just and equitable for a Government to grant a patent that might be worthless from want of novelty, it was shown that it was impossible for an examiner to be quite sure of an invention being new, for it might easily happen that, a manufacturing process for instance, was being used that he, the examiner, knew nothing of, and a patent be granted for it to a new inventor, or for him to refuse a patent for a valuable invention that might have the appearance of an old one which old invention had been a failure when tried, while the former was a success. The American system of examination was alluded to and it was shown that the American people themselves were not, to say the least, particularly in favour of it. The examination as to novelty by the German Patent Office was stated to be more unsatisfactory than the American. The question as to fees was then gone into, and after mentioning the opinion expressed inferentially by the Society of Arts, by their Bill of 1882, for the improvement of the patent law, which was brought in the year prior to the great Government measure, the author said that it appeared to be to him, as a matter of public policy, advisable not to lower the present cost of a patent, for already a vast deal of rubbish was patented and it was practically impossible to exclude this by any amount of examination without at the same time killing many valuable inventions, and further, that some of this rubbish might be very hurtful in the hands of ignorant persons; for if an individual has to pay a substantial sum for a thing, he will think twice before he spends his money, and will consider more carefully, and go into the matter more thoroughly, than he would otherwise do if the sum he had to pay for it was but a trifle.

Peat.—At a meeting of the Civil and Mechanical Engineers' Society, a paper was read on January 4th, by Mr. R. Nelson Boyd, M.I.C.E., F.G.S., &c. After alluding to the formation of peat in nature, its origin, localities, and characteristics, the author referred to its antiseptic qualities and the valuable products obtained from it by destructive distillation. Its great value, however, lay in the possibility of converting it into a useful fuel. The author then described some of the machinery in use for preparing peat for fuel in different countries, and mentioned the reports made on the value of peat to Government in this country, as well as the result obtained in practical experiments on railways and steamers. After giving various analyses of peat and its products, the author described the system invented by Mr. Blunden, by which the peat is forced out of the machines used, in the form of thick drain tiles or tubes. Mr. Blunden's general process was then described, and the cost of his plant stated. The economic value of peat was considered—first, as a fuel; secondly, as to the products from it by distillation; and—thirdly, as to the coke or charcoal produced. At present the two latter have a value

in the markets, as the distillation produces a fair amount of sulphate of ammonia, and the coke or charcoal has a special value owing to its freedom from impurities. It was also pointed out that eventually the large deposits of peat will have a greater value as the cost of coal increases, which it must do in course of time.

Bombrite.—A new explosive, styled "Bombrite," has been invented, and is being put on the market by Mr. K. C. Edmunds, of 34, Surrey Street, Strand, London, W.C. We understand the following advantages are claimed for "Bombrite" over other known explosives:—1. The explosive is absolutely safe to store or transport, as it will not explode through friction, concussion, or spontaneous combustion. 2. When set fire to it will burn slowly, and can easily be put out by water or other means. 3. It will only explode in close confinement, and requires no detonator or special fuse; it never hangs or misses fire. 4. The power of the explosive is great, and one advantage over most explosives is the slow expansion of the gases, and consequently less injury to the rock by shattering it. 5. It is almost smokeless, and leaves behind no injurious fumes. 6. Climatic changes have no effect upon it, neither does it deteriorate through keeping. 7. Owing to a curious chemical discovery which enables waste products to form a large proportion of its active ingredients, it can be sold at a much lower rate than dynamite or any other explosive. 8. Tests and reports of mining experts state "Bombrite" to be an explosive of the highest grade and commercial value. 9. It can be used in a loose condition, and also in cartridges and military shells.

George Sealy.—On January 20th there was launched from the yard of the Bergens Mekaniske Værksted, Bergen, a finely modelled steel screw steamer of the following dimensions:—Length over all, 222 ft.; breadth, moulded, 29 ft.; depth, 14 ft. 4½ in. The ship is built to the highest class in the Norwegian Veritas, and has raised quarterdeck aft, bridge amidship, and top-gallant forecastle. Cellular double bottom for water-ballast in main and after holds, and peak tanks fore and aft, steam windlass, three large steam winches, steam steering gear, &c. Every modern improvement has been embodied in her construction and outfit. She is specially built for the American fruit trade and has a large number of ventilators to the holds, as well as heating apparatus for the trade in winter. In a large deck-house aft is fitted comfortable cabins for twelve passengers, as well as saloon, &c. The engines are triple-compound, with cylinders 17 in., 28½ in., and 47 in. diameter, and 33 in. stroke. I.H.P. about 750. Extra large steel boiler, constructed for a pressure of 175 lbs. per square in. Speed, fruit-laden, 11½ knots. The ship was named *George Sealy*, and is built to the order of Harold Trgens, Esq., of Bergen. The keel of a similar vessel is to be laid down shortly.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from December 7th, 1893, to January 11th, 1894.

23500 C. V. Divan, jun. Improved rotary engines.
23516 E. Lagosse. Improvements in generators.
23517 E. Latham. Improvement in generators.
23549 H. White and E. Whitwam. Steam boilers.
23553 J. D. G. Thompson. Steam engines.
23561 F. F. Fisher & B. Whalley. Screw propellers.
23566 P. L. Carman (J. Schaefer, Germany). Boiler explosion preventer.
23571 J. Roots. Internal combustion engines, &c.
23577 E. Petersen. Water tube or tubulous boilers.
23610 A. C. Wright. Boiler and like tubes.
23611 T. Clarke. Gauges for metal and like purposes.
23616 W. C. Lea. Protecting steel cylinders.
23636 T. Hampton. Manufacture of armour plates.
23637 J. Mills. Valves for boilers and the like.
23653 J. W. and E. H. Deans. Mechanism for marine engines.
23659 T. F. Fairlie. Steam boilers.
23660 J. McDonald (Prinie and W. Duncan, Queensland). Valves and pistons.
23668 J. L. Berry and S. M. Arnold. Pulsating steam pumps.
23725 H. B. & J. S. Watson. Steam valves.
23812 F. Barnes. Apparatus for propelling ships.
23816 J. H. Clasper. Roller seats for racing boats.
23822 J. N. Murphy and P. F. Murphy. Steam valve.
23841 J. and A. Niclausse. Purifying and heating feed water.
23842 H. H. Grenfell and T. Newton. Steering indicators.
23845 W. L. Milne. Steamboat propulsion.
23879 R. G. Foot. Propelling apparatus for ships.
23887 W. P. Thompson (Improved zigzag grate bar company U.S). Boiler furnaces.
23914 J. A. Bisson. Insulation of submarine cables.
23918 J. Forster. Manufacture of weldless chain.
24020 C. Burgon and H. Burgon. Friction gear.
24054 S. R. Wheeler and A. O. Alcock. Vertical boilers.
24124 J. W. Reed. Steam generators.
24167 J. F. Green. Self-transporting lifeboat.
24170 F. & E. Trier. Semi-solid lubricators.
24188 R. P. Davis. Wire brush for removing boiler scale.
24196 H. H. Lake (N. Roser, France). Steam engines.
24198 F. C. Younghusband, H. W. Jones, and H. J. Maskell. Controlling the action of torpedoes.
24213 G. V. Priestley. Steam generators.
24252 E. H. Beckett and C. W. Roberts. Cranes.
24257 C. S. Irwin. Steering apparatus for boats.
24281 H. H. Lake (The Harvey Steel Co., United States). Armour plates.
24339 G. A. Haig. Method of propelling ships.
24349 J. A. O'Leary. Compasses, dividers, &c.
24362 A. Hughes. Taking bearings on board ship.
24372 W. P. Hoskins. Ship's berths.
24397 F. W. Golby (C. Thierry, France). Injectors for steam boilers.
24434 E. Howl. Steamer boiler and other furnaces.
24435 A. Cefl. Apparatus for stopping a ship's way.
24454 J. Shanks, jun. Compound steam engines.
24467 A. Hughes. Signal lanterns for ships.
24469 C. E. Wolff and D. L. Hutchinson. Recording weir gauges.
24547 J. Moore. Launching ships.
24572 G. Mitchell. Double-acting hydraulic valve.
24575 G. W. Sivewright. Building twin bulkheads.
24585 E. C. Martin. Rowlocks for boats.
24594 J. Tucker. Fastening battens of ships.
24627 G. P. Marchant. Night signalling on ships.
24643 R. Muir. Rotary engine.
24655 P. M. G. Caldagues. Boiler.
24663 M. J. Adams and T. Leech. Valves.
24672 Taylor and Challen and S. W. Challen. Pumping engines.
24683 G. B. Newton and W. Holiday. Packing for steam engines.
24689 A. F. Yarrow. Tubulous boilers.
24690 A. F. Yarrow. Tubulous boilers.
24691 A. F. Yarrow. Feed apparatus for multiple boilers.
24703 E. Lofts. Throwing lines to wrecked vessels.
24729 B. Willcox (L. M. G. D., Belleville, France). Steam generators.
24733 P. D. de la Grée. Improved steam generators.
24743 R. Stipperger. Valves.
24753 G. W. Sivewright. Construction of steamships.
24757 W. Arnold and W. Crowther. Stopping engines.
24761 The Manchester Oxygen (Brin's Patent) Co., Limited and W. M. Jackson. Utilising pressure in cylinders.
24785 G. H. Jones. Steam generating apparatus.
24817 J. F. Crease. Battleships.
24818 H. F. Donaldson. Cranes.
24833 J. H. Hamilton. Internal combustion engines.
24837 T. R. and T. A. Bayliss. Lids or covers for lubricant.
24841 W. Thomson. Mariner's compass.
24845 C. Flach. Steam boiler furnace.
24876 J. Foley. Improvements in wrenches, &c.
24877 A. and C. Stewart and J. Farmer. Feeding boilers.
24883 E. Small. Seaming sheet-metal cylinders.
24891 A. Lavaud. Steam boilers.
24896 R. H. Lea. Covers for lubricators, &c.
24897 E. S. Luard. Lubricators for engine cylinders.
24919 F. Meredith. Water-tube boilers.
24933 J. C. Sewell. Heat non-conducting material.
24943 J. Bredell. Rowlocks.
24954 C. W. Ahrens. Attachment for bow of ship.
24967 E. Müller and R. Minnich. Pipes or tubes.
24971 E. G. Allison. Valve.
24980 E. Kaselowsky. Distributing motion for water-pressure engines.

24998 W. R. Lysaght. Rolling steel sheets.
25019 A. McInnes. Steam boiler and other furnaces.
25038 E. Hall-Brown. Compound steam engines.
25042 F. Bosshardt (J. R. Frikart, Germany). Corliss valves.
25058 J. Dyson and R. H. Williamson. Screw blades.
25085 H. Morris and F. Bastert. Frictional appliances for revolving shafts.
25092 J. Willoughby. Ventilating coal bunkers.
25100 H. Gardner (R. J. Henderson, United States). Regulating the speed of shafts.
26 T. W. Bailey. Marine boilers.
32 J. Maclean. Arrangement of stoves in boats.
39 W. H. Le Fevre (A. L. J. F. Colomes, France). Application of compressed air to life-belts.
40 J. F. Stuart. Ship's compasses.
48 T. A. Crompton. Fire shield for boilers.
51 S. Quincey. Rotary engines.
55 G. Wilson. Apparatus for propelling vessels.
64 P. D. de la Grée. Packings for stuffing-boxes.
75 G. Newsum. Boilers for heating apparatus.
86 S. Diplock and J. E. Hussey. Sealed covers for boilers.
116 P. A. Newton (H. S. Ross and Seabury, United States). Steering propellers.
188 J. M. Allan. Tubulous boilers.
200 R. Long and W. E. Mort. Refrigerating machinery.
217 F. Price. Propeller, pump or motor.
224 S. Dixon. Drilling boiler rings, &c.
282 G. J. and A. Saxon and J. Scholes. Metallic packing.
285 G. R. Turner. Construction of ships.
287 J. Griebenow. Marine engine governors.
305 H. P. Holt. Driving gear for oil engines.
315 B. G. Martin and J. Murrogh. Fluid-pressure governor for engines.
328 J. Tinn. Galvanising sheet iron and steel.
330 J. Smith. Slide-valve for steam engines.
331 F. Paget. Stoking of steam boiler furnaces.
367 C. A. Parsons. Steam engines.
414 N. C. Jessup. Lee wings for vessels.
428 J. W. Brooke. Friction clutch.
435 J. F. Lackersteen. Steam generators.
443 J. Burghardt. Springing out the packing ring in steam pistons.
460 B. A. Burgess and D. P. Rous. Steam lubricators.
471 D. and W. H. Wood. Covers for manholes of boilers.
483 E. Seitz and R. P. Park. Centrifugal pumps.
554 C. A. Allison (W. E. Thompson, on the high seas). Ships' indicators.
560 E. A. Reeves. Instrument for use at sea.
567 W. S. Sargeant. Water-tube steam generators.
644 E. Lachmann. Recording the speed of governors.

BOARD OF TRADE EXAMINATIONS.

EXTRA FIRST CLASS.

January 13th—Geo. Tulip—Ex. 1C Sunderland.

NOTE.—1C, denotes First Class; 2C, Second Class.

December 16th, 1893

Aikenhead, C.W.	1C	N.Shields
Anderson, Chas.	2C	London
Baillie, John ...	2C	Leith
Barrie, Robert..	2C	Greenock
Baskett, Geo. C.	2C	Cardiff
Boughton, D. A.	1C	,,
Broughton, J. H.	2C	Hull
Campbell. W. S.	1C	Leith
Cashin, Timothy	1C	Cardiff
Constable, Jas..	2C	Dundee
Cuthill, Guy....	2C	Dublin
Cutchie, Fredk.	1C	N.Shields
Davidson, M. ..	2C	,,
Deslandes, E.F.	1C	Cardiff
Dickson, Geo. ..	2C	Leith
Dixon, Edward	2C	N.Shields
Eadie, John W.	1C	Greenock
Harrington, J.W.	2C	N.Sh'lds
Henderson, D...	2C	Greenock
Hunter, E. L...	2C	Leith
Hunter, G. L...	2C	Greenock
John, Edmnd.T.	2C	Cardiff
Kennedy, A. B.	2C	London
Kerr, James H.	1C	Greenock
Lang, John.....	2C	,,
Lewis, Alfred ..	1C	London
Mathias, Wm...	2C	Dublin
Miall, Hy. J. R.	1C	Plymouth
Nicholls, T. H..	2C	Cardiff
Orr, Oliver T...	1C	Greenock
Owen, William..	1C	Liverpool
Parsons, Sam. J.	1C	,,
Paterson, Wm...	1C	,,
Peacock, F. J...	1C	Hull
Pollands, Joseph	2C	Leith
Ratsey, Hugh B.	1C	London
Reed, H. H.....	2C	N.Shields
Riddet, Alex. ..	2C	Greenock
Robinson, H. J..	2C	L'n'derry
Robson, Benj...	1C	Greenock
Rule, Wm. H...	2C	Cardiff
Sherratt, L. W.	1C	Liverpool
Sproul, P. J....	2C	Dublin
Taylor, Arthur..	2C	London
Thomas, R......	1C	Dublin
Thorburn, John	2C	Greenock
Tyrie, John W.	2C	Dundee
Walker, Thos. J.	2C	,,
Watt, Robert E.	1C	Leith
White, James...	1C	N.Shields
White, Thos. J.	1C	Liverpool
Williams, T. F.	1C	,,
Woodward, W.H.	2C	Cardiff

December 23rd, 1893.

Allan, Jno. Wm.	1C	N.Shields
Allsopp, George	2C	Hull
Beswick, G. N.	2C	N.Shields
Blakey, William	2C	Hull
Bourke, Charles	1C	Liverpool
Burn, F. O......	2C	N.Shields
Cameron, J. R..	2C	Glasgow
Crighton, A.....	1C	,,
Davies, Jno.....	2C	Liverpool
Denton, A. F...	1C	London
Douglas, Robert	1C	W.Hartpl
Dunsmore, Wm.	2C	London
Edward, J......	2C	Glasgow
Elder, Wm. G..	2C	,,
Gray, H. G.....	2C	,,
Harding, Wm..	2C	Liverpool
Hayes, F. C....	1C	London
Hilton, John ..	2C	Liverpool
Hodgen, Alex...	1C	Glasgow
Hughes, Thos.H.	2C	Liverpool
Johnson, Thos.	2C	,,
Lang, Jno.......	2C	N.Shields
Marinder, A. E.	2C	London
Milne, Robert...	2C	,,
Morgan, Andrew	2C	Glasgow
Munro, Wm. W.	1C	London
Newton, Wm. R.	1C	W.Hartpl
Ornsby, Robt ..	2C	,,
Parkin, T. W...	2C	Hull
Payne, William	2C	W.Hartpl
Playle, Thos. S.	2C	N.Shields
Purvis, M......	2C	Sundrlnd
Ramsey, Jno. ..	1C	N.Shields
Rogers, Jno. S.	1C	Falmouth
Ruston, J. A. E.	2C	W.Hartpl
Simcock, Philip	2C	Liverpool
Simpson, Saml.	2C	W.Hartpl
Slade, W. R....	1C	London
Slater, W. J....	1C	,,
Smellie, Thos...	2C	Liverpool
Stanger, D. C...	2C	Glasgow
Storr, Fredk. R.	2C	Hull
Sutherland, J.D.	2C	N.Shields
Varrelmann, F.W.	2C	London
Vaux, Jno. S. ..	2C	N.Shields
Walker, W. H. ..	1C	W.Hartpl
Weight, Wm. T.	1C	N.Shields
Wilson, Wm. S.	2C	,,

December 30th, 1893.

Carr, Thomas ..	1C	N.Shields
Cooper, J. R. ..	1C	,,
Gibb, G. M. ..	2C	,,
Gourdie, Robert	1C	Liverpool
Greenlaw, David	2C	London
Lawton, A.	2C	,,
Miller, Thos. M.	1C	Aberdeen
Rhind, John F.	2C	,,
Roberts, Wm. ..	2C	London
Shilston, R. D.	2C	N.Shields
Smythe, A. G...	2C	London
Shortridge, Rd.	2C	Liverpool
Urquhart, Geo.	2C	Aberdeen
White, A. T. ..	2C	London
White, Thomas	2C	Liverpool
Wight, Henry D.	2C	N.Shields
Williams, A. B.	2C	London
Winchester, T.	2C	Aberdeen
Young, Thos. ..	2C	N.Shields

January 6th, 1894.

Bingham, John	1C	Liverpool
Callen, Jas. ..	1C	Glasgow
Cornfoot, Wm.	1C	Cardiff
Cuthbertson, C.	1C	Greenock
Davies, D. L. ..	1C	Cardiff
Davison, R. T.	1C	,,
Giffen, Jno.	1C	Glasgow
Hardie, A. M'P.	2C	,,
Henderson, A.	2C	Greenock
Howell, Geo. B.	1C	Cardiff
Kerr, Richard ..	1C	Glasgow
King, Hugh	2C	Dublin
M'Cullum, R. ..	2C	Glasgow
M'Donald, D. ..	2C	,,
Milne, David ..	2C	Liverpool
Montgomerie, J.	1C	Glasgow
Norman, M. W.	2C	London
Ringrow, H. W.	1C	Liverpool
Scott, D. E. ..	2C	Glasgow
Sharer, A. F. ..	1C	Greenock
White, C. S. ..	2C	Cardiff
Williams, E. M.	2C	London

January 13th, 1894.

Arnot, David ..	1C	Leith
Blaxell, Fred W.	2C	Liverpool
Blench, Wm. A.	2C	W.Har'pl
Bisset, John R.	2C	Liverpool
Clark, John	1C	London
Dixon, N. W. ..	1C	Liverpool
Elborne, John ..	1C	London
Frodsham, E. J.	2C	Liverpool
Hall, William L.	2C	London
Helsby, Walter	2C	Cardiff
Hornsby, John A.	2C	N.Shields
Jenkins, W. J...	2C	Plymouth
Lloyd, John T.	2C	Cardiff
Millar, James ..	2C	Liverpool
Ord, William T.	1C	W.Hartpl
Paton, Wm. S.	2C	Liverpool
Reid, F. W.	1C	Leith
Rundle, John R.	2C	W.Har'pl
Sinclair, Alex. J.	2C	London
Thickins, E. W.	1C	Cardiff
Thomson, W. ..	1C	London
Torrington, A.	2C	Cardiff
Walworth, Chas.	2C	N.Shields
Wilson, Michael	2C	,,
Wood, George ..	2C	London

January 20th, 1894.

Adam, Jas.	1C	Glasgow
Bettoney, S. W.	2C	Liverpool
Brutton, F.	2C	Bristol
Burgess, Thos...	2C	N.Shields
Cramman, R. ..	2C	,,
Dingle, F. C. ..	2C	London
Fairfull, Alex...	1C	,,
Hope, Tom	2C	N.Shields
Mathieson, U. P.	2C	,,
Minns, R. J. ..	2C	Liverpool
Moffatt, John R.	1C	N.Shields
Morgan, John ..	2C	Liverpool
Newman, A. W.	2C	Bristol
Quinn, Michael	2C	Liverpool
Rynsaard, J. W.	2C	N.Shields
Stockley, C. R.	2C	,,
Thompson, Geo.	1C	Leith
Thomson, Jas...	2C	Liverpool
Vickers, J. S. ..	1C	London
Williams, Fdk.	2C	N.Shields
Williams, H. J.	2C	Bristol

The Marine Engineer.

LONDON, MARCH 1, 1894.

AS it appears that there is at present a distinct demand for light vessels in the Navy of surpassing speed in the form of cruisers and torpedo-boat destroyers, it may be well to direct the attention of our readers to one of the most important items of such a vessel, viz., the boiler. We have been accustomed hitherto to see such boilers of the return flue marine type, or of the locomotive type, all of them consisting essentially of a heavy containing shell, forming the reservoir for the water and steam, and fitted with internal heating surfaces in many various ways, according to the ingenuity of the designers. It requires little consideration at once to see that any boiler of such a type is a long way from an ideal one as regards a minimum of weight to give the largest heating surface and capacity of storage for steam. The water-tube boiler is evidently the coming boiler for maximum efficiency, with minimum weight of material and water. Yet there is considerable prejudice at present against this form of boiler, and perhaps with some reason as yet, as we are only now upon the threshold of suitable designs for water-tube boilers, and the prejudice created by early imperfect constructions will take a long time to eradicate. It is curious how little the deadweight of water in a boiler is regarded, and yet we are within the mark when we state that the weight of water carried by a boiler is the largest factor in the combined weight of boiler and water together. If, then, it is sought to reduce the weight of the material of the containing shell and heating surfaces of a boiler, it is equally as important to proportionately reduce the deadweight of water itself. For this purpose it is easy to see that the water-tube form of construction is unrivalled, as in large cylindrical or rectilinear vessels the contents are as the square of the diameter or size, whilst the weight of shell and heating surface or surfaces, that ought as far as possible to be utilized as heating surface, is proportional only to the diameter or external measurements. All water space should therefore be reduced to a minimum film of water above the heating surface, either by the breaking up of the water space into small tubes, or by the displacement of the water from the interior of large chambers by internal flues, also utilized as heating surfaces. It would appear also that a boiler, to have the largest possible heating surface for maximum efficiency, should, if possible, have no material, merely containing pressure or water that is not a heating surface, and should have no walls to grate or flues that are not heating surfaces. It is not easy to see how these conditions are even approximately to be fulfilled in a boiler which at the same time shall be a fairly simple and reliable structure. If all steam and water-containing surfaces are to be essentially heating surfaces, what is to contain and control the heated gases of combustion enveloping them, for all external smoke cases are material wasted on surfaces which do not serve to transmit heat to the water or steam. If tubes also are used as walls conducting the heat to the water and confining the heated gases within those walls, the external half of the tubes are inefficient as heating surfaces. Perhaps a combination of feed-heating surfaces with internal direct evaporating surfaces may be one way of solving this problem, but at any rate there are here a series of problems requiring great ingenuity for their solution, and we consider that as yet water-tube boilers are but in their infancy and present a very favourable field for invention. No fire-brick walls to grate or ashpan are admissible as representing weight without corresponding heating surface. The circulation of the water in reduced water areas must also be carefully looked to, or the ebullition of steam in such confined channels may serve to force out the water and leave the tubes or channels dry. Though the water space may be restricted as far as possible in thin films above the heating surfaces, care must be taken to provide a sufficiency of steam space, so that the boiler may supply steam without tendency to prime. To test the theoretical value of any boiler as most nearly approaching ideal perfection, the heating surface should be first taken, and the gross weight of material in shell, flues, tubes, fire box, and grate, be divided into pounds weight per square foot of heating surface, and further divide the whole weight of water carried by the heating surface in order to ascertain the proportional depth of water per square foot of heating surface. It will be surprising how far present aggregate results, so analysed, are from the theoretical perfection desirable.

WHILST Great Britain is agitating and being agitated on the question of an immediate increase to her Navy, France seems to be steadily plodding on with the scheme adopted in 1892, for which a credit of forty millions was voted to be spread over a period of ten years. It is considered in France to be an unwise policy to follow that of England and Italy, who build their ships by fits and starts, generally under the influence of a scare; but on the other hand it is deemed better to determine deliberately, as to the amount to be especially expended to achieve a given position within a considerable number of years, so that during that period the designs may have an opportunity of always being so far as possible up to date. It is extraordinary

that England who possesses the greatest financial resources, and is generally considered to be of a phlegmatic and steady-going disposition, should be so subject to fits and starts in her Navy development. That we cannot afford to be left behind in our claim for the supremacy of the seas is acknowledged by all, and yet such a unanimous concurrence of opinion seems only to produce effects which are intermittent and spasmodic. By the end of 1902, France will possess eighty-one new vessels, of which fifty-six will be cruisers of exceptional speed, approaching to 19 or 20 knots. In the battleships our neighbours seem to be content with a speed of 17 knots, but this will be considerably beyond the performance of the ironclads now afloat, which will then be almost rendered obsolete. Fortunately, the French dockyards are not remarkable for their speed of completion of ironclads as compared with our own country, but they seem to be now making great efforts to amend in this particular, and to produce heavy ironclads in the space of five years. In the present year no fewer than thirty-two vessels will be started on the stocks, viz., three ironclads, five second-class cruisers, and one third-class, one sea-going torpedo boat, five first-class and four second-class torpedo boats, and thirteen other vessels and boats of various descriptions. Three of the ironclads to be started this year are of 11,000 tons, of which two are to be built at Brest and Lorient respectively, and one is to be placed with a private firm. Of the cruisers, four are to be built by private firms and one at Cherbourg Arsenal. A third-class cruiser which is to develop a speed of 20 knots, was lately put on the stocks at Rochefort. The sea-going torpedo boat is to develop a speed of 30 miles an hour, with forced draught, and will be built on the lines of the *Forban*, whilst the first-class torpedo boats are expected to develop a speed of 23½ knots. We see that one of the torpedo boats for the *Foudre* has been ordered in England, and is to be built of aluminium. In view of all this energy abroad it behoves England to bestir herself right soon, and not with an uncertain view as to requirements, but steadily to face a programme which shall provide all the vessels that may be required in the space of a few years, to maintain such superiority at sea as will provide an effective guarantee for the safety of our enormous sea-borne commerce, upon which our very existence depends, in case of unforeseen war.

NAVAL experts are much exercised in mind at present by the extreme tendency to rolling that has lately been exhibited by the *Resolution*, the *Ramillies*, and the *Empress of India*. It is said that these vessels have reached the extreme coefficient of from 40 deg. to 45 deg. of roll, which extreme degrees have obviously scarcely ever been considered within the range of possibility, as the indicators for clinometers do not admit of a greater angle than 30 degrees. It is reassuring, however, to learn from such eminent authorities as Mr. W. H. White and Sir E. J. Reed, that the actual stability or stiffness of a vessel are not to be measured or gauged by their tendency to roll, and that such extreme rolling does not indicate a tendency to capsize. In fact it is stated that the stiffest ships are often the least steady while crank ships are often the steadiest in a seaway. The ill-fated *Captain*, for instance, was remarkably steady under sail as well as under steam, and was by no means lively in a seaway or given to rolling. When the actual stability of the *Captain* at a maximum heel of 37 deg. is compared with that of the *Royal Sovereign* class of ironclads, assurance as to the stability of the latter becomes confirmed, since we find that the moment of stability of the former was only 7,000 foot tons, whilst that of the *Royal Sovereign* class of ironclads is 30,000. In fact we would suggest that tendency to roll may be taken almost as inverse to stability, since a vessel that is very stable and therefore tends to keep its deck always parallel with the surface of the sea on which it rests is more likely to roll in a lateral sea by following too closely the disturbance of the surface water; whilst, on the other hand, a ship which is crank implies that its hull has little hold, as it were, upon the water, and that therefore serious disturbances of the surface of the water on which it rests produce little effective reaction upon the hull. The inertia, then, of the hull itself under such circumstances would tend to keep the hull steady in spite of the variable surface of the sea about her. This is a curious conclusion at which to arrive, as the lively motion and quick change of the decks, as a gun platform, from a steady horizontal position much militates from its efficiency as a fighting platform, and yet may be the result of the improved design of hull now adopted as regards stability compared with the *Captain*. We evidently cannot afford to dispense with the stability of the hulls as a protection against capsizing at extreme angles of heel, but it is a pity if this entails a shifting and tossing platform for gun fire. Surely our naval architects can devise a design for the hulls of ironclads which shall give the desired stability and yet be fairly free from rolling. Dr. Elgar, we believe, pins his faith to bilge keels but as now added to the bilges of hulls as at present constructed, they are but awkward excrescences, far from strong in their construction, and may so far spread the beam below water line, that ironclads so fitted may not be able to avail themselves of the ordinary dock accommodation. What would appear to be wanted is a new departure

in hull design which shall retain the stability of a large beam and high free board, and which shall offer the advantages of bilge keels in a scientific form as part of the actual design of the hull and not as mere excrescences added thereto. We shall be glad to receive any suggestions from our readers.

RESEARCH COMMITTEE ON MARINE ENGINE TRIALS.*

ABSTRACT OF RESULTS OF EXPERIMENTS ON SIX STEAMERS, AND CONCLUSIONS DRAWN THEREFROM IN REGARD TO THE EFFICIENCY OF MARINE BOILERS AND ENGINES.

By Professor T. HUDSON BEARE, F.R.S.E., of London.

THE experiments with which the present paper deals in an abstract form are those reported at previous meetings of the Institution, and published with the discussions thereon in the Proceedings of the four years 1889-92. The six steamers, of which the engines and boilers were tested in these trials, were the *Meteor* (see June number, 1889); the *Fusi Yama*, *Colchester*, and *Tartar* (see June number, 1890); the *Iona* (see June number, 1891); and the *Ville de Douvres* (see July number, 1892).

Steamers.—The six steamers were of very different types; their leading dimensions and other particulars are summarised in the accompanying Table 16.

Earle's Shipbuilding and Engineering Co. Her engines were built in 1888-9. The run was made from Hull southwards, and then to Harwich, the trial lasting 11 hours, weather very fine.

The *Tartar* had arrived from Australia a week before the trial. The engines and boilers, which were built in 1887, had been opened out, cleaned, and overhauled, and the cargo discharged; the trial was made therefore with the ship light, only in water ballast. The run was down Channel, and lasted 10 hours 5 minutes; the weather was rough.

The *Iona* also had just arrived from a voyage, and her engines had been overhauled by the makers immediately before the trial. She was built and engined in 1889. The trial was made on a run south from the Tyne, and lasted 16 hours, the weather being fair.

The *Ville de Douvres* before the trial had been running for about eighteen months on her regular route between Dover and Ostend, having been delivered by the builders to the Belgian Government in February, 1890. She was overhauled beforehand, and was tried on a special run from Ostend up the North Sea and back. The trial lasted 9 hours, with fair weather throughout.

In summarising the results of these six trials, it will be most convenient to deal with the boilers and engines separately. The various dimensions for each will be given in a condensed form, and then the results obtained during the trials; finally from these results any conclusions which seem to be brought out by the figures will be stated, and any inferences as to the influences of the varying conditions on the general efficiency of the machinery. The boilers, as the generators of the steam afterwards used by the engines, will in the natural order be dealt with first.

General Description of Boilers.—There were three single-ended sets, namely, those of the *Fusi Yama*, *Iona*, and *Ville de Douvres*; and three double-ended sets, those of the *Meteor*, *Colchester*, and *Tartar*. It seems advisable therefore to group the boilers under these two heads. Natural draught was used with all the

TABLE 16.—*Steamers; dimensions and speed on trial.*

Steamer.	Description.	Owners.	Makers of Engines.	Length.	Breadth.	Depth Moulded.	Draft on Trial.	Displacement on Trial.	Mean Speed on Trial.
				Feet.	Feet.	Feet.	Ft. Ins.	Tons.	Knots.
Meteor	Screw; triple expansion. Leith and London. Cargo and passengers.	London and Edinburgh Shipping Co.	J. & G. Thomson, Clydebank.	261·0	32·1	19·3	15 1½	2,090	14·6
Fusi Yama	Screw; compound. Cargo coaster.	Gellatly, Hankey, Sewell & Co.	M. Samuelson, Hull.	214·3	29·3	20·5	18 11¾	2,175	—
Colchester	Twin-screw; compound. Harwich and Antwerp. Passengers.	Great Eastern Railway.	Earle's Shipbuilding & Eng. Co., Hull.	281·0	31·0	15·3	12 0½	1,675	14·4
Tartar	Screw; triple-expansion. Large cargo.	Gellatly, Hankey, Sewell & Co.	T. Richardson & Sons, Hartlepool.	332·0	38·0	27·0	12 0	2,250	—
Iona	Screw; triple-expansion. Large cargo.	Herskind & Woods.	W. Gray & Co., West Hartlepool.	275·1	37·3	21·8	20 7½	4,430	8·6
Ville de Douvres	Paddle; compound. Dover and Ostend. Mails and Passengers.	Belgian Government.	Société Cockerill, Seraing.	271·0	29·0	15·5	9 0¾	1,090	17·1

The *Meteor* was tested during a run south from Leith to London under ordinary working conditions, that is with natural draught. Her boilers are designed to work with forced draught on the run north in order to do the run five hours quicker, the engines developing therefore much greater power than they did during the trial; in considering the results this fact must be clearly borne in mind. She was built and engined in 1887, and her engines had been overhauled about three months before the trial, which lasted 17 hours 9 minutes, with weather fair.

The *Fusi Yama* was tested on an ordinary voyage down Channel from Gravesend to Portland. Her engines were built in 1874, and had been overhauled by Messrs. Rait & Gardiner immediately before the trial. The trial lasted 14 hours 9 minutes; weather fair at first, rough at finish.

The *Colchester* had just undergone her first overhaul by Messrs.

double-ended boilers, and also with the single-ended set of the *Fusi Yama*; while forced draught was used with the other two single-ended sets. The forced draught for the boilers of the *Iona* was obtained by closing the fronts of the ash-pits, and passing air into them through gridiron valves, from a trunk into which a fan forced the air at a pressure of 0·86 in. of water; a supplementary supply from a branch trunk was also delivered into the combustion chambers through perforated plates, securing therefore small streams of air to mix with the gases after they had passed the furnace bridge, in order to promote perfect combustion in the flame-box. The *Ville de Douvres*, on the other hand, had closed stoke-holds, with an average air-pressure in them of 0·7 to 1·0 in. of water, the air being supplied by centrifugal fans.

The principal over-all dimensions are given in Table 17. The following additional particulars will probably be found useful in comparing the results obtained with these boilers.

Meteor. Fox's corrugated flues are used, and the tubes and furnaces all open into one common combustion chamber As

* Paper read on February 1st, at a meeting of the Institution of Mechanical Engineers.

TABLE 17.—*Boilers.*

Steamer.		Number of Boilers.	Diameter.		Length.		Number of Furnaces in each boiler.	Fire-Grate. Width.		Fire-Grate. Length.		Tubes. External Diameter.	Tubes. Length.		Funnels. Number.	Funnels. Internal Diameter.		Funnels. Height.		Material used.
		No.	Ft.	Ins.	Ft.	Ins	No.	Ft	Ins.	Ft.	Ins.	Ins.	Ft.	Ins.	No.	Ft.	Ins.	Ft.	Ins.	
Meteor	Double-ended	2	13	6	16	0	6	3	3	6	0	2½	6	4½	1	7	3	61	0	Steel
Colchester	Double-ended	2	13	0	18	8	6	3	4	5	6	3½	6	7⅞	2	5	5	47	0	Iron
Tartar	Double-ended	2	13	0	14	9	4	3	8	5	6	3	5	7¼	1	7	0	57	0	Steel
Fusi Yama	Single-ended	1	13	3¾	11	0	3	2	11½	5	10	3¾	7	5	1	4	6⅛	43	2	—
Iona	Single-ended	2	13	3	10	0	2	3	6	3*	9	3	6	10⅜	1†	6	3	51	9	Steel
Ville de Douvres	Single-ended	4	13	0	10	0	3	3	0	6	6¾	2½	7	1⅝	2	5	3	49	8	Steel shells, the rest Iron

*Length on trial 3 feet only. †A damper is placed in funnel 17 ft. 8 ins. above fire-bars.

TABLE 18.—*Boilers, summary of observations and relations.*

Steamer.	Meteor.	Colchester.	Tartar.	Fusi Yama.	Iona.	Ville de Douvres.
Boilers, number of main boilers	2	2	2	1	2	4
,, single-ended or double-ended	double	double	double	single	single	single
Furnaces, total number	12	12	8	3	4	12
Heating surface, total . . . square feet	6,648	5,820	5,226	2,257	3,160	7,340
,, ,, tubes . . . square feet	5,760	4,770	4,366	1,689	2,590	6,280
Grate area, total . . . square feet	208	220	161	52	42	236
,, ,, per furnace . . . square feet	17·33	18·33	20·12	17·33	10·50	19·67
Tube surface to total heating surface . . per cent.	86·7	81·9	83·5	74·8	81·9	85·6
Total heating surface to grate area . . . ratio	32·0	26·5	32·5	43·4	75·2	31·1
Tube surface to grate area . . . ratio	27·7	21·7	27·1	32·5	61·7	26·6
Grate area to flue area through tubes . . . ratio	—	5·5	4·5	4·0	2·3	6·7
,, ,, to area through funnel . . . ratio	5·0	4·8	4·2	3·2	1·4	5·5
Draught, natural or forced	natural	natural	natural	natural	forced	forced
Barometric pressure . . . lbs. per square inch	14·90	15·00	14·6	14·80	14·58	14·84
Boiler pressure above atmosphere . lbs. per square inch	145·2	80·5	143·6	56·84	165·0	105·8
Fuel per square foot of grate per hour . . . lbs.	19·25	26·10	11·93	18·98	22·4	31·3
,, per square foot of heating surface per hour . lbs.	0·602	0·987	0·367	0·437	0·298	1·01
,, per I.H.P. per hour . . . lbs.	2·01	2·90	1·77	2·66	1·46	2·32
Carbon-value per I.H.P. per hour. . . lbs.	1·76	2·65	1·62	2·33	1·49	2·30
Feed-water per sq. ft. of heating surface per hour . lbs.	4·49	7·39	4·13	3·48	2·73	9·02
,, ,, per lb. of fuel . . . lbs.	7·46	7·49	—	7·96	9·15	8·97
,, ,, ,, ,, from and at 212° F. . lbs.	8·21	8·53	—	8·87	10·63	9·84
,, ,, ,, carbon-value, from and at 212°F. lbs.	9·62*	9·34	—	10·10	10·42	9·94
HEAT Balance-sheet.						
Calorific value per lb. of fuel . . . Th. U.	12,770	13,280	14,995	12,760	14,830	14,390
Feed-water takes up . . . per cent.	62·0	62·0	—	67·2	69·2	66·1
Funnel gases carry away . . . per cent.	18·5	28·0	22·1	23·5	16·2	26·8
Imperfect combustion . . . per cent.	3·6	1·3	0·0	0·0	0·0	0·0
Evaporating moisture in fuel . . . per cent.	1·2	0·4	0·0	0·9	0·0	0·0
Unburnt carbon in ashes . . . per cent.	2·9	1·7	1·4	—	1·6	3·1
Balance unaccounted for (radiation) . . per cent.	11·8	6·6	—	8·4	13·0	4·0
Temperature, outer air . . . Fahr.	—	55°	55°	55°	62°	64°
,, funnel gases . . . Fahr.	791°	835°	477°	578°	452°	910°
,, feed-water. . . . Fahr.	163°	113°	101°	129·5°	106°	158°
,, boiler steam . . . Fahr.	363°	324°	362°	304°	373°	342°

*Allowing 3 per cent. for clinker not in chemical analysis.

already mentioned, the boiler has been designed to work with forced draught as well as with natural draught.

Colchester. The boilers have large steam drums 4 ft. diameter and 18 ft. long; and one common combustion-chamber for each end of the boiler. The furnaces are plain flues. Henderson's fire-bars were in use, mainly with the object of securing a more rapid rate of combustion.

Tartar. There are two combustion chambers for each boiler, common to opposite furnaces. Fox's corrugated furnaces are used.

Fusi Yama. The furnaces and tubes all open into one common combustion chamber; the furnaces are plain flues. A large tall steam dome is carried on the top of the boiler.

Iona. Purves' corrugated flues are used. The fan for forced draught is driven by a Chandler single-acting high-speed engine developing about 2 H.P. Each furnace opens into its own combustion chamber.

Ville de Douvres. The forced-draught fans are driven by two Brotherhood engines, each developing about 14 H.P. Each furnace has its own combustion chamber; the flues are plain.

In Table 18 is given a complete summary of all the important dimensions and their relation to one another, for grates, heating surface, tubes, and funnels; also the mean steam-pressures during the trials, rates of fuel combustion and water evaporation, and finally a summary of the heat account for each boiler.

Observations made.—In each trial the coal was weighed in baskets hung from spring balances, and then emptied in heaps upon the stoke-hold floors; and the rate of consumption of fuel as well as the amount was determined. The feed in all the trials—except that of the *Ville de Douvres*, in which meters were used—was measured by passing it on its way to the boiler through two tanks, which were filled and emptied alternately, thereby again insuring knowledge of rate as well as of quantity used. The boiler pressures were observed at fixed intervals, as were also the temperatures of air, of feed, and of escaping furnace-gases. Lastly, samples of the furnace gases were taken at fixed times for subsequent analysis; and also samples of the coal and ashes for the same purpose. The air-pressure in the funnels, &c., was measured by U water-gauges. From these data a fairly complete heat-account for the boilers can be calculated.

Fuel.—The coal used on the different trials varied considerably in quality. A summary of the chemical analysis, carbon value, calorific value, and evaporative power, is given in Table 19 for each steamer. It will be seen that the coal used in the *Meteor*, *Colchester*, and *Fusi Yama* trials was much inferior to that in the case of the three other vessels; and that in the *Meteor* and *Fusi Yama* coal the moisture present was great, over 10 per cent. for the *Meteor*. The calorific values are all calculated on the assumption of the complete combustion of all the hydrogen present, making allowance for the latent heat of the steam so formed.

Ashes.—The quantities and percentages of ashes weighed out at the end of the trials, with particulars as to the cleaning of the fires, are given in Table 20. In every trial the fire was cleaned at the end, and the resulting clinker and ashes weighed; a sample was taken, and afterwards by ignition the proportion of unburnt carbon in it was estimated. In the heat balances given in the various reports no attempt has been made to estimate the proportion of loss due to the unburnt carbon present in the ashes; it may however be worth while to estimate it per pound of coal burnt, more especially as the balance unaccounted for, which must be ascribed mainly to this and to radiation, varies considerably. In Table 20 are given the total ashes and their percentage of the total fuel put on the fires; also the percentage of carbon in the

TABLE 19.—*Fuel.*

Steamer.	Name of Coal.	Analysis of Fuel as used.					Per Pound of Fuel.		
		Carbon.	Hydrogen.	Water.	Ash.	Nitrogen, Sulphur, Oxygen, &c., by difference.	Equivalent Carbon-value.	Calorific value.	Evaporative Power. Lbs. of Water from and at 212° Fahr.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Lb.	Th Units.	Lbs.
Meteor	Scotch, Shawfield.	70·31	4·88	10·68	3·46	10·67	0·878	12,790	13·24
Colchester	Monk Bretton, Yorks, and Hucknall, and Shireoaks, Notts.	71·89	5·42	4·25	4·08	14·36	0·913	13,280	13·75
Tartar	Welsh, Penrikyber.	87·93	4·22	1·07	3·42	3·31	1·031	14,995	15·52
Fusi Yama	West Hartley, Tyne.	70·85	4·71	8·60	5·11	10·73	0·878	12,760	13·21
Iona	Walbottle, Tyne.	82·34	5·47	1·94	2·90	7·35	1·020	14,830	15·35
Ville de Douvres	Block Fuel.*	81·65	3·98	2·41	5·30	3·66	0·99	14,390	14·90

* Made at Marcinelle and Chatelineau, Belgium.

TABLE 20.—*Ashes.*

Steamer.	Cleaning of Fires.	Ashes.		Carbon in Ashes.		Loss of heat from unburnt carbon in ashes.	
		Total.	Proportion of total Coal.	Proportion.	Total.	Per minute.	Proportion.
		Lbs.	Per cent.	Per cent.	Lbs.	T. Units.	Per cent.
Meteor	End of trial only.	4,477*	6·51	—	—	24,580§	2·88
Colchester	do.	2,220†	3·5	43·73	962	21,420	1·68
Tartar	do.	291‡	2·2	65·53	185	6,506	1·36
Fusi Yama	do.	278	2·0	—	—	—	—
Iona	Once during trial.	430	2·9	56·19	242	3,659	1·57
Ville de Douvres	do.	4,760	7·2	42·86	2,040	54,930	3·10

* Consisting of 1,671 lbs. ashes and 2,806 lbs. clinker, equivalent to 2·43 and 4·08 per cent. of the total coal.
† Actual quantity weighed out, 2,890 lbs.; but this included ashes made in getting up steam, and in preliminary run before start of trial.
‡ For a period of 6 hours 53 minutes only.
§ This is an estimate of the loss owing to the fact that, in selecting lumps for chemical analysis, bad, stony lumps were rejected.

ashes, and the equivalent total carbon therefore lost in the whole of the ashes. The results expressed as percentages of heat-value in the fuel vary from 1·36 to 3·10 per cent. It has been assumed that the balance of the mineral matter, found in the fuel by chemical analysis, and not shown in the ashes, either went up the funnel as fine dust, or more probably remained on the fire-bars as clinker at the end of the trial. If these percentages are added to those for feed-water evaporated, loss of heat in furnace gases, imperfect combustion, &c., the balance, apart from errors of observation, can be put down only to radiation.

FEED-WATER.—There are several points of importance in the various trials, to which attention must be drawn before dealing with the actual results.

Meteor. All the steam corresponding with the measured feed went to the main engines, and to a small Worthington pump which fed the boilers. The circulating-pump engine, dynamo engine, and all the deck engines were supplied with steam by a donkey boiler. The supplementary feed was not separately measured; it was drawn from the exhaust of the circulating-pump engine and dynamo engine. The feed was heated in the hot well up to 163·1° Fahr. by means of an apparatus devised by the chief engineer.

Colchester. All the steam from the measured feed went to the main engines; only one feed-pump was in use; the supplementary feed was not measured separately. The circulating-pump engine and others were all worked off a donkey boiler. The mean feed temperature was 113° Fahr.

Tartar. All the steam from the measured feed went to the main engines, the auxiliary engines being worked from the donkey boiler. One of the feed-pumps was used at start; but later the donkey pump, drawing its steam from the main boilers; the supplementary feed was not measured separately. Mean feed temperature 101° Fahr.

Fusi Yama. All the steam from the measured feed went to the main engines; the supplementary feed was not measured separately. The auxiliary engines were worked off a donkey boiler. Mean feed temperature 129·5° Fahr.

Iona. All the steam from the measured feed went to the main engines. Here the circulating pumps and feed-pumps were all worked by the main engines. The supplementary feed was separately measured. The average feed temperature was 106° Fahr.; in ordinary working the feed is heated to a much higher degree than this, by draining the jackets into the feed suction-pipe.

Ville de Douvres. The feed, measured by a Kennedy positive piston water-meter, went to the main boilers, and supplied steam not only to the main engines but also to the auxiliary engines. The average feed temperature was 158° Fahr.

It will be seen therefore that in some cases the circulating pump was driven by an independent engine, in others by the main engines. As however this is a question affecting the efficiency of the engines rather than of the boilers, it will be advisable to defer any remarks on this point. In Table 21 are given in a convenient form for reference certain data as to feed, evaporation, &c. Neglecting the results of the *Tartar*, it will be seen that the single-ended boilers on an average evaporate from and at 212° Fahr. 10·15 lbs. of water per lb. of carbon value, as against only 9·48 lbs. for the double-ended boilers.

PRIMING.—This important subject was brought into great prominence from the results of the *Tartar* trial. In the earlier trials no attempt was made to measure the priming, because its presence was not suspected; and the results of those trials gave no reason for supposing that such an action was taking place. In the two trials after that of the *Tartar*, however, it was determined to measure this factor; this was done in both trials by means of the salt test. Unfortunately, with the *Iona* the apparatus broke down, and only one test was made, which showed priming to the amount of 2·87 per cent. In the *Ville de Douvres* trial more tests were made, all of which showed practically no priming.

The case of the *Tartar* is one which must be dealt with somewhat fully. It is clear that the whole of the measured feed cannot have been evaporated by the quantity of coal used; if it had been 84·1 per cent. of the total heat of the coal would have been spent in doing it, leaving only 15·9 per cent. for loss in chimney gases, radiation, &c. The analysis of gases, however, and the chimney temperature, enable us to calculate that 22·1 per cent. must have gone away in the waste gases. A careful inspection of the log sheets has revealed nothing in the least anomalous in the observations. Unless, therefore, nearly 20 per cent. of the feed-water which was measured through the tanks never reached the boilers at all, the author can see no other explanation than priming. The amount of the supplementary feed being normal, such a loss between feed tanks and boilers would at once have shown itself in the gauge glasses; but as a matter of fact, though the water-level in the boiler did fall, it was very little, and corresponds in amount to less than 1 per cent. of the total feed

TABLE 21.—*Feed-Water, in relation to Boiler and Fuel.*

Steamer.	Feed-Water used per hour.	Mean Temperature.		Heat in Boiler.		Water Evaporated from and at 212° Fahr.	
		Feed-Water.	Boiler.	Taken up per lb. of Steam.	Utilized per lb. of Fuel.	Per lb. of Fuel.	Per sq. foot of heating surface per hour.
	Lbs.	Fahr.	Fahr.	Th. Units.	Th. Units.	Lbs.	Lbs.
Meteor	29,860	163·1°	363°	1,062	7,922	8·21	4·49
Colchester	43,020	113·0°	324°	1,100	8,240	8·53	8·42
Tartar	21,564	101·0°	362°	1,123	—	—	—
Fusi Yama	7,860	129·5°	304°	1,077	8,570	8·87	3·48
Iona	8,616	106·0°	373°	1,122	10,265	10·63	3·17
Ville de Douvres	66,180	158·0°	342°	1,060	9,509	9·84	9·90

As to conditions likely to cause priming, there is the fact recorded that the ship was light and the weather stormy, so much so that the trial was carried on with difficulty towards the end. There is every probability therefore that the water in the boilers was in a state of violent agitation, and by the action of the stays would be broken up into foam, a condition most likely to lead to priming. That there must have been considerable priming the author believes is clearly shown by calculations from the indicator diagrams as to the amount of steam actually present in the cylinders. Considering first the high-pressure cylinder, there was present just after cut-off behind the piston, that is including the clearance volume, 3·39 lbs. of steam per revolution; while just before the point of release this had become 4·33 lbs., being a gain of 0·94 lbs. or over 27 per cent., equivalent to 18 per cent. of the feed. There was no jacket in use on this cylinder; and on making a similar calculation for the three unjacketed engines, it is found that the total steam at the end of the stroke is almost exactly what it was at the beginning, the re-evaporation being very slight. Unless therefore either the piston or the valves were leaking badly, which there is no reason to suppose, as the engine had just been overhauled, this increase must have been caused by evaporation of water in the cylinder itself. It seems to the author that this difference can possibly be explained by the priming; with the steam there came over in a finely divided state water intimately mixed up with the whole body of the steam. As the steam expanded after cut-off and fell in pressure, this water evaporated. This action would be confined to the core of the mass of steam; that which came in contact with the walls and surfaces would behave as usual, condensing and forming a fine film all over the surfaces, and owing to the absence of jackets would be only very slightly re-evaporated. There is

some difficulty however in this explanation, as it is not clear where the heat necessary for this considerable evaporation can have come from; the loss of internal energy in the steam as it fell in pressure is not sufficient. The great amount of water noted in the intermediate cylinder the author thinks can be explained by initial condensation in the high-pressure cylinder, apart altogether from priming; the film of water deposited on the high-pressure cylinder surfaces, and not entirely re-evaporated owing to the jacket not being in use, would be swept into the receiver and collect there, and be eventually carried into the intermediate cylinder. The whole difficulty, the author feels, points to the absolute need of priming tests in all such trials, if the results are not to be vitiated by an unknown quantity, as in this case. Under normal working conditions most probably priming would be unlikely with such boilers; but the fact that it did occur proves the need of always testing for it. It is noteworthy that in the *Iona*, where the one test did show priming, though less than 3 per cent., there was great condensation in the high-pressure cylinder.

Funnel Gases.—In every trial samples of the furnace gases were regularly drawn off, and afterwards analysed by Mr. Charles J. Wilson. In the *Meteor* trial the samples were unfortunately all spoiled except one: and therefore the results in this case are not so valuable as in the other trials. The temperature of the furnace gases was also measured by a special mercury thermometer. In Table 22 are given the mean chimney-draught and temperature and the analyses of the gases by weight; also the actual weight of air used per lb. of fuel, and the percentage of heat lost in the furnace gases.

TABLE 22.—*Funnel Gases.*

Steamer.	Analyses of Gases by weight. Carbonic Acid.	Carbonic Oxide.	Oxygen.	Nitrogen.	Temperature of Gases, and Height above boiler when taken.		Dry Air per lb. of Fuel. Theoretical.	Actual.	Specific Heat of Gases.	Heat lost in Gases.	Chimney Draught in inches of water.
	Per cent.	Per cent.	Per cent.	Per cent.	Fahr.	Feet.	Lbs.	Lbs.	Sp. Heat.	Per cent.	Inches.
Meteor*	18·17	0·75	5·71	75·37	791°	12	9·8	13·0	—	18·5	0·31
Colchester	13·59	0·22	10·78	75·41	835°§	—	10·1	18·5	0·238	23·0	0·38F 0·34A
Tartar	9·98	0·00	14·19	75·83	477°	—	11·6	31·6	0·238	22·1	0·22
Fusi Yama*	11·17	0·00	12·48	76·35	578°	—	9·8	22·8	—	23·5	0·28
Iona	12·12	0·00	12·01	75·87	45[illegible]°	30	11·4	24·5	0·243	16·2	0·25
Ville de Douvres	16·84	0·00	8·44	74·72	910°§	—	11·1	17·9	0·243	26·8	1·07

* Only one sample of gases from the "Meteor," and only two from the "Fusi Yama."
§ Temperature only approximate, because in about 37 per cent. of the readings in the "Colchester," and in nearly all in the "Ville de Douvres," it exceeded the limit of the thermometer.
F=Forward funnel; A=After funnel.

TABLE 23.—*Funnel Gases; Weight, Volume, and Velocity.*

Steamer.	Funnel Gases leaving tubes per min. in each boiler. Weight.	Volume.	Sectional Area of Tubes in each boiler.	Velocity of Gases through tubes.	Tube Surface per lb. of Gases per min.
	Lbs.	Cub. Ft.	Sq. Feet.	Ft. p. min.	Sq. Feet.
Meteor	467	14,690	—	—	6·16
Colchester	933	30,3[illegible]0	20·00	1,518	2·56
Tartar	522	12,280	17·89	686	4·19
Fusi Yama	391	10,200	13·00	785	4·32
Iona	200	4,590	9·13	503	6·49
Ville de Douvres	581	20,010	8·81	2,272	2·70

In Table 23 is given the weight of gases which must have passed up the funnel per minute from each boiler; and as the temperature of these gases immediately afterwards is known (Table 22), their volume and the velocity with which they passed out of the tubes into the smoke-box or funnel uptake can be approximately calculated.

When the figures in the fifth column are divided by those in the sixth, the ratios so obtained will give some idea of the relative loss of heat in the waste gases from the different boilers, as follows:—

Meteor	—	Ratios of Velocity of Gases through tubes to Tube Surface per lb. of gases per minute.	18·5 per cent.	Percentages of total heat that are sent up funnels.
Colchester	594·0		23·0 " "	
Tartar	163·9		22·1 " "	
Fusi Yama	181·7		23·5 " "	
Iona	77·5		16·2 " "	
Ville de Douvres	841·0		26·8 " "	

The temperature of the *Iona* gases was measured at a point 30 feet above the bars, and therefore the velocity would be higher than here given, because the actual temperature just after leaving the tubes must have been much greater.

Air Supply.—In two cases there were double funnels; the air supply has therefore been calculated for each separately, and compared with the rate of combustion of the fuel on the grates, and with the chimney-draught.

In the *Colchester* the air supply per pound of coal was 16·00 lbs. for the forward funnel, and 21·90 lbs. for the aft; while the fuel burnt per square foot of grate per hour was 25·94 lbs. for the forward boiler, and 26·27 lbs. for the aft. The mean chimney-draught was 0·38 in. of water in the forward funnel, and 0·34 in. in the aft. In the forward funnel the much smaller air supply with nearly 12 per cent. more draught is marked, and seems to point to the fact that it is not possible merely from draught alone to say what are the proportionate quantities of air passing through two furnaces.

In the *Ville de Douvres* the air supply per pound of fuel was 19·07 lbs. for the forward funnel, and 16·78 lbs. for the aft; while the fuel burnt per square foot of grate per hour was 32·1 and 30·44 lbs. respectively. The mean chimney draught in the two funnels was the same. Here again the figures point to the same conclusion as in the *Colchester*.

Radiation.—In the heat balance-sheet given in Table 18, the balance accounted for is presumably due in the main to radiation. In order to check this, the external surfaces of the boilers, from which radiation takes place, have been calculated on the assumption that they are plain cylinders closed at each end. This supposition, though not correct, must nevertheless give fairly correct comparative figures, which are shown in Table 24.

TABLE 24.—*Heat lost by Radiation from Boiler Surfaces.*

Steamer.	Radiating Surface. Total	Per lb. of Fuel burnt per minute.	Difference between Temperature of Steam and of Air.	Heat lost by Radiation.
	Sq. Feet.	Sq. Feet.	Fahr.	Per cent.
Meteor	1,929	28·9	308°	11·8
Colchester	2,021	21·1	269°	6·6
Tartar	1,735	54·2	307°	—
Fusi Yama	730	44·4	249°	8·4
Iona	1,384	88·1	311°	13·0
Ville de Douvres	2,693	21·9	278°	4·0

With a boiler of the locomotive type but with only a low rate of coal consumption, the author has found a loss by radiation of 10 per cent. with a 2-in. coating of non-conducting material. The losses in Table 24 therefore are apparently what would be expected in boilers with the rates of consumption here met with. The high radiation in the *Iona* there can be no doubt is mainly due to the large size of the boilers used for the power developed, and therefore to the excessive radiation-surface per pound of fuel burnt. In the *Meteor* and the *Fusi Yama* it must be remembered that the results can be considered only approximate, owing to the few samples of gas collected.

BOILERS, GENERAL CONCLUSIONS.—The *Tartar*, on account of the uncertainty of the amount of priming, must be omitted from consideration. The efficiency of the double-ended boilers is 62 per cent., of the single-ended 67·5; this gain is partly due to less loss in furnace gases, but more apparently to the prevention of imperfect combustion, even with a high rate of fuel consumption. The *Meteor* boilers would in all probability give a higher efficiency with forced draught, the small size of the tubes being a drawback when working with natural draught. The high efficiency of the *Iona* working with such small grates would seem to point to the fact that, by the adoption of some system of forced draught and a reduction in the length of the grates, the efficiency of the average marine boiler would be sensibly increased. At the same time the boilers of the *Ville de Douvres* show that, where a very high rate of fuel consumption has to be obtained from a given boiler, then forced draught and large grates with only the normal proportion of heating surface can be used, and the boiler will still be efficient. The greater loss incurred by sending the furnace gases away hotter is partly counterbalanced by the proportionally smaller radiation per pound of fuel. Unless some plan can be devised for utilising the waste heat passing away through the chimney, it seems that about 70 per cent. is likely to be the maximum amount utilized of the total heat of the fuel in the present type of marine boiler.

ENGINES.—In three of the steamers the engines were two-cylinder compound, and in the other three triple-compound. They will therefore be discussed in those two groups, and also in regard to the jacketing of cylinders, and other points of general design. The two-cylinder compound sets were the *Fusi Yama* ordinary inverted vertical, the *Colchester* twin inverted vertical, both screw engines; and the *Ville de Douvres* inclined paddle engines. None of these had jacketed cylinders. The triple sets were the *Meteor* and the *Tartar* with all three cylinders jacketed, but on the trial of the *Tartar* the intermediate and low-pressure jackets only were in use; and the *Iona* with the high-pressure cylinder jacketed. All of these engines were of the ordinary inverted marine type. Table 25 gives their leading dimensions, and the following additional particulars will be of value in considering the results obtained.

Fusi Yama. The cranks are at right angles, the low-pressure leading. Steam is distributed to each cylinder by a single slide-valve worked by ordinary link motion. The receiver forms a belt round the high-pressure cylinder.

Colchester. The two engines are entirely separate, a condenser between being common to both. The cranks are at right angles, the high-pressure leading. The valve-gear is ordinary link-motion. The high-pressure cylinder has a piston-valve, and the low-pressure a double-ported slide. The receiver forms a belt round the high-pressure cylinder.

Ville de Douvres. The engines are inclined. The high-pressure crank leads, the two cranks being at right angles. The receiver encircles the high-pressure cylinder. The high-pressure cylinder is fitted with a pair of piston valves, the low-pressure with one; and in each case the gear is the Allan link-motion.

Since there are no jackets to any of these three sets of engines, there are no liners to any of the cylinders.

Meteor. The cranks follow in the order—high, intermediate, low. The ends of the cylinders are not jacketed, the total length of the jackets being about 4 ft. All the valves are piston-valves, worked by ordinary link-motion; the valves are single for the high-pressure cylinder, double for the others.

Tartar. The cranks rotate in the sequence—high, low, intermediate. The cylinders are fitted with jackets on the body and on both ends; except the high-pressure cylinder, which has only body and top end jacketed. The valves are piston-valves for the high-pressure and intermediate cylinders, and a double-ported slide-valve for the low-pressure, all worked by Wyllie's elliptical gear, with independent adjustment for the cut-off.

Iona. The cranks rotate in the order—high, intermediate, low. Only the high-pressure cylinder is jacketed. The valves for the high and low-pressure cylinders are ordinary double-ported, and for the intermediate a Trick slide-valve is used. The intermediate receiver encircles the high-pressure valve-chest and part of the jacket, and the low-pressure receiver another part of the high-pressure jacket.

OBSERVATIONS MADE.—In addition to those already described, the following were also made. Indicator diagrams were taken simultaneously from both ends of every cylinder at half-hourly intervals, all engine-room and other gauges and also the counter were read at the same intervals. In the *Iona* trial, diagrams were also taken from some of the pumps and from the receivers. The diagrams were used to determine the power, initial steam pressures, release pressures, back pressures, and also the quantity of steam present in each cylinder at various points in the stroke. Unfortunately it was not possible to measure the quantity of condensing water used, nor in several of the trials the rise of temperature of this water; there is therefore no possibility of making a complete balance-sheet for the engines, such as was given in the reports for the boilers. Considering the enormous quantity of water used for condensing purposes with such large engines, there does not seem any prospect of successfully measuring it; meters, the author thinks, are out of the question.

From the observations it is possible therefore to make only two calculations for the balance sheet; one the total heat received per minute by the engines, including therein heat given both to the cylinder steam and to the jacket steam; and the other the useful work done per minute. The ratio of these two quantities gives the actual efficiency of the engines. Unfortunately in the only trial in which all the cylinders were jacketed, the steam condensed in them could not be measured apart from that used in them. What proportion of the heat unaccounted for in the balance sheet was rejected in the condensing water, and what

TABLE 25.—*Engines.*

Steamer.	Cylinders. Diameters. High.	Inter.	Low.	Stroke.	Ratios of Volumes.* Inter/High	Low/High	Clearance Volumes.† High.	Inter.	Low.	Condensing Surface. Total.	Revolutions per minute.
Two-cylinder Compound.	Ins.	Ins.	Ins.	Ins.	Ratio.	Ratio.	Per cent.	Per cent.	Per cent.	Sq. Feet.	Revs.
Fusi Yama	27 35		50·30	33·00		3·42	8·50		5·00		55·59
Colchester	30 00		57·00	36·00		3·70	9·39		6·23	3,000	86·00 / 87·10
Ville de Douvres	50·12		97·12	72·00		3·84	15·00		12·00	6,540	36·82
Triple Compound.											
Meteor	29·37	44·03	70·12	47·94	2·35	5·89	12·40	9·30	8·02	3,200	71·78
Tartar	26·03	42·03	68·95	42·00	2 64	7·16	14·51	9·25	5·10	2,250	70·00
Iona	21.88	34·02	56·95	39·00	2·46	6 93	12·41	10·11	7·64	1,360	61·10

* Ratio of Volumes swept through by pistons. † Clearance Volumes in percentage of volumes swept through by pistons.

TABLE 26.—*Steam Pressures.*

Steamer.	Mean Steam Pressures per square inch, absolute. Boiler.	High Initial.	Mean Effective Pressures per square inch. High.	Inter.	Low.	Total reduced to Low.	Exhaust in Low-p. cylinder per square inch. Below atm.	Absolute.	Vacuum in Condenser per square inch. Below atm.	Absolute.
Two-cylinder Compound.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Fusi Yama	71·64	65·10	30·74		10·87	19·90	10·90	3·90	12·48	2·32
Colchester	95·50	{ 79·30 74·40 }	45·65 42·07		13·42 12·42	24·80	{ 10·60 10·50 }	4·40 4·50	12·49	2·51
Ville de Douvres	120·64	104·04	55·49		15·54	30·17	8·78	6·06	10·12	4·72
Triple Compound.										
Meteor	160·10	149·30	58·46	19·50	12·38	29·90	11·60	3·30	12·17	2·73
Tartar	158·20	136·00	36·89	20·07	7·18	19·80	10·50	4·10	12·90	1·70
Iona	179·58	157·08	46·65	20·44	7·16	21·13	12·74	1·84	13·88	0·70

TABLE 27.—*Power Measurement.*

Steamer.	Piston Constants.* High.	Inter.	Low.	Indicated Horse-power. High.	Inter.	Low.	Total.
Two-Cylinder Compound.	H.P.	H.P.	H.P.	I.H.P.	I.H.P.	I.H.P.	I.H.P.
Fusi Yama	5·36		18·32	168·2		203·1	371·3
Colchester	{ 10·71 10·84 }		39·55 40·06	490·3 457·9		532·2 499·3	1,022·5 957·2
Ville de Douvres	25·99		98·56	1,444·0		1,533·0	2,977·0
Triple Compound.							
Meteor	11·31	26·00	66·65	662·0	507·0	825·0	1,994·0
Tartar	7·73	20·42	55·27	283·7	408·5	395·2	1,087·4
Iona	4·41	10·82	30·54	205·6	221·2	218·6	645·4

* Piston Constant = horse-power per lb. of mean effective pressure per square inch on piston.

went in radiation, there is therefore not the means of stating, though by certain calculations, the amount can be approximately arrived at in the *Iona* and the *Ville de Douvres*.

Power Measurement.—The indicators used were as follows: in the *Meteor* trial, Crosby; in the *Fusi Yama* for the high-pressure cylinder, Darkes, and for the low-pressure, Richards; in the *Colchester, Tartar*, and *Iona*, trials, McInnes; and in *Ville de Douvres*, Richards. In all cases the indicators were as close to cylinders as possible, the connections being short large pipes, free from bends. The instructions for taking diagrams issued to each observer engaged on this work in any trial (see our June number, 1890) show what great care was taken to ensure accuracy in the diagrams. In Tables 26 and 27 are given results obtained from the diagrams, and also the mean readings from some of the gauges.

One of the most striking features in Table 26 is the considerable difference between the average back-pressure in the low-pressure cylinder and the condenser pressure. In Table 28 is shown for each steamer the amount of this difference, and the equivalent increased H.P. which would have been obtained in the low-pressure cylinder, had its back-pressure been the same as that of the condenser; and this increase would of course have been brought about without the expenditure of any more steam.

As regards the *Ville de Douvres*, however, this comparison hardly suffices, because her condenser vacuum was so bad on the day of the trial that the loss was really much more serious. Omitting the *Iona*, where a remarkable good vacuum was obtained, the average absolute condenser-pressure in the other four steamers was 2·31 lbs., whilst that in the trial of the *Ville de Douvres* was as much as 4·72 lbs.; a further loss of pressure of 2·41 lbs. per square inch should therefore be allowed for this, which would increase the loss of power by 237·5 H.P. and make the total percentage 12·4 in the *Ville de Douvres* instead of 4·4 per cent. In every case therefore, except the *Meteor*, this loss is sufficiently great to justify some attempt to diminish it by increasing the size of the exhaust passages or other suitable means; from the results with the *Meteor* low-pressure cylinder it seems clear that it can be reduced to a very small amount. It should be stated that these calculations assume the condenser gauges to have been indicated correctly; they were tested only in the *Iona* and *Ville de Douvres*.

TABLE 28.

Difference between Back-pressure in Low-pressure Cylinder and Pressure in Condenser; and equivalent Horse-power.

Steamer.	Difference between Back-pressure in Low-pressure Cylinder and Condenser Pressure per square inch.	Equivalent Horse-power. Actual.	Percentage of Total Horse-power developed.
Two Cylinder Compound.	Lbs.	H.P.	Per cent.
Fusi Yama	1·58	28·94	7·8
Colchester	1·94	{ 77·20 77·20 }	7·8
Ville de Douvres	1·34	132·10	4·4
Triple Compound.			
Meteor	0·57	37·99	1·9
Tartar	2·40	132·60	12·2
Iona	1·14	34·82	5·4

Another notable point is the considerable wire-drawing of steam between the boiler and the high-pressure cylinder. This is no doubt largely due to the action of the valve-gear, since the gauges on the high-pressure valve-chest show a much closer agreement with the boiler; for instance, with the *Iona* the pressures are—boiler 179·58, valve-chest 174·58, initial in cylinder 157·08 lbs. per square inch. It certainly does not seem worth while to

TABLE 29.—*Feed-Water in relation to Engine and Power.*

Steamer.	Feed-Water used in main Engines.			Heat per minute.			Engine Efficiency.
	Per minute.	Per hour.	Per I.H.P. per hour.	Taken up by Feed-Water. Total.	Taken up by Feed-Water. Per I.H.P.	Turned into Work.	
Two-Cylinder Compound.	Lbs.	Lbs.	Lbs.	Th. Units.	Th. Units.	Th. Units.	Per Cent.
Fusi Yama	131	7,860	21·17	141,100	380·0	15,870	11·2
Colchester	717	43,020	21·73	788,700	398·4	84,630	10·7
Ville de Douvres	1,103	66,180	20·77*	1,092,000	366·8	127,300	11·7
Triple-Compound.							
Meteor	497·7	29,860	14·98	528,600	265·6	85,240	16·1
Tartar	359·4	21,564	19·83†	—	—	—	—
Iona	143·6	8,616	13·35	161,100	249·6	27,590	17·1

* Total, including auxiliary engines 22·23 lbs. per I.H.P. per hour.
† This includes what was most probably priming water.

design a boiler to carry such a heavy pressure as 180 lbs. absolute, if nearly 13 per cent. of this is to be lost between the boiler and the first cylinder: though no doubt the superheating produced may lessen initial condensation, and thereby make up the loss.

FEED-WATER.—This having already been dealt with very fully in connection with the boilers, it will be necessary to give only a few additional figures, referring the consumption of feed-water to the engine and to the H.P. developed. In all the trials prior to that of the *Iona* the circulating pump was driven by a separate engine deriving its steam from a separate boiler, while in the *Iona* it was driven by the main engine. In the *Ville de Douvres* trial, both this engine and the fan engines drew their steam from the main boilers; but supplementary trials were afterwards made to determine their steam consumption, and corrections are made in the total feed in the main trial, to allow for the steam they used. In Table 29 the figures apply to the main engines only. The actual economy of the machinery in the *Iona* is therefore really greater in comparison with the other engines than is shown by Table 29, because the rate of steam consumption in the auxiliary engines would be much higher than in the main engines.

STEAM-JACKETS.—None of the two-cylinder compound engines were fitted with jackets; attention is therefore confined to the triple engines for the purpose of comparison. Unfortunately it was not possible to measure separately the steam condensed in the *Meteor* jackets, but only the steam pressure in the jackets was measured; the wetness of the steam in the cylinders is known therefore only approximately. For the other two steamers the quantity condensed in the jackets is known, and therefore the percentage of total feed so used. The necessary figures are given in Table 30. There are thus only two examples of the high-pressure cylinder jacketed, against one unjacketed or practically so. On calculating from the indicator diagrams the steam present in the high-pressure cylinder just after cut-off, it is found that the percentages of total feed so accounted for are:—*Meteor* 77·1; *Iona* 63·4; *Tartar* 45·2 per cent. In the *Tartar* it is impossible to say how much of the excessive wetness of the steam may have been due to priming, and how much to initial condensation intensified moreover by priming. In the *Iona* the percentage of total feed condensed in the steam-jacket is not high, and may to some extent explain the greater wetness of the steam than in the *Meteor*, especially when it is remembered that the *Iona* jacket gave heat not only to the high-pressure cylinder but also to the second receiver.

On examining the percentages of steam present near the end of the stroke in the intermediate cylinder, the results given in the reports appear anomalous. They are:—

Meteor 80·2 per cent. steam, or 3·1 per cent. more than at cut-off in high-p. cyl.
Tartar 58·2 " " 13·0 " " " " "
Iona 74·9 " " 11·5 " " " " "

The *Iona* having no jacket to her intermediate cylinder, it seems difficult to believe that there has been much re-evaporation in this cylinder. It has therefore been thought worth while to calculate the percentage of steam present just before release in the high-pressure cylinder, in order to detect whether there was condensation or re-evaporation going on during the stroke in that cylinder. The following are the results of the calculation:—

Tartar 63·9 per cent. steam at release, or 18·7 per cent. more than at cut-off.
Iona 65·5 " " " 2·1 " " "

These results seem to show slight re-evaporation in the *Iona* during the high-pressure stroke, and a great amount in the *Tartar*: which appears extraordinary when it is remembered that the *Iona* high-pressure cylinder was well jacketed, while in the *Tartar* the jacket was practically not in use. In order to test the matter more conclusively, the total weight of steam present in the high-pressure cylinder and clearance has been calculated for two points, one just after cut-off and one just before release. The figures are given in Table 31.

The great re-evaporation in the *Tartar* the author thinks is to be explained only by the assumption of priming; a large quantity of water must have been carried over with the steam, and afterwards evaporated. The difficulty however still remains of explaining where the heat needed for this purpose came from; and at present the author sees no way of accounting for it satisfactorily.

In Table 32 is shown for each steamer the percentage of total feed present as steam in the high-pressure cylinder after cut-off, and before release in this and the other cylinders.

From these figures it is seen that just after cut-off in the high-pressure cylinder the unjacketed two-cylinder compound engines actually show present as steam a much greater proportion of the total feed than do the jacketed triple engines. As the only explanation which seems at all feasible is that the area of surface in the jacketed cylinders must be greater per pound of steam entering per minute, this has been calculated out, and the results are shown in Table 33. An inspection of the indicator diagrams shows that in almost all of them the compression in the high-pressure cylinder was carried up nearly to the initial pressure of the entering steam, except in the *Colchester* where the compression was small. It seems therefore unlikely that the clearance surfaces can have had any great effect in causing condensation of the entering steam; the difference of temperature must have been slight, and the clearance walls must have been almost dry. On the other hand the surface of the cylinder walls is exposed to a considerable range of temperature, namely from the exhaust temperature up to that of the initial steam. It is therefore to be expected that, where this surface was larger per pound of steam admitted per minute, the condensation would be greater for a given range of temperature. The figures in Table 33 for the *Meteor* and *Iona*, both jacketed, show that this expectation is fulfilled pretty closely; the anomalous figures for the *Tartar*, when its small surfaces and low range of temperature are considered, can be explained only on the assumption of the enormous influence exerted by the priming water present.

In the non-jacketed engines, no explanation seems satisfactory for the high percentage of steam present in the *Fusi Yama*; judging from the large surface exposed to the entering steam, considerable initial condensation would be expected, while as a matter of fact there appears to have been but little. It is generally found that an engine with large initial condensation is uneconomical, and more so than an engine with small initial

TABLE 30.—*Steam-Jackets.*

Steamer.	Cylinders Steam-Jacketed.	Absolute Steam-Pressure per square inch.						Feed used in Jackets.
		Cylinder Jackets.			High-p. Valve-chest.	No. 1 Receiver.	No. 2 Receiver.	
		High.	Inter.	Low.				
Triple Compound.		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Per cent.
Meteor	High, Inter, Low.	145·9	92·4	71·7	†149·3	51·4	21·1	—
Tartar	* Inter, Low.	—	67·1	28 6	146·0	§60·7	§18·4	3·94
Iona	High.	179·58	—	—	174·58	—	—	‡4·30

* High-pressure jacket was shut off; but steam leaked into it, sufficient to show pressures varying from 14·6 to over 64·6 lbs. absolute.
† This is the mean initial pressure in the high-pressure cylinder.
§ These are the pressures in the intermediate and low-pressure valve-chests, not in the receivers.
‡ In addition to this, the drain from steam-pipe and high-pressure valve-chests was 0·61 per cent. of the total feed.

condensation; but the figures for the *Meteor* and *Iona* present an apparent discrepancy, their initial condensation being respectively 22·9 and 36·6 per cent., while the steam consumption per H.P. per hour is 14·98 and 13 35 lbs. respectively. The explanation however is most probably to be found in the much larger ratio of expansion adopted in the *Iona*, and the consequent partial saving of the loss due to incomplete expansion of steam down to the back-pressure.

EXPANSION OF STEAM.—By measurement of the approximate point of cut-off from mean indicator diagrams, the total ratio of expansion has been calculated as follows:—

		Times.	Boiler Pressure.
Two-cylinder Compound.	Fusi Yama	6·1	56·84 lbs.
	Colchester	6 1	80·50 lbs.
	Ville de Douvres	5·7	105·80 lbs.
Triple Compound.	Meteor	10·6	145·20 lbs.
	Tartar	15 7	143·60 lbs.
	Iona	19·0	165·00 lbs.

It will be seen that, except in the "Fusi Yama," the two-cylinder compound engines with their late cut-off obtain only a comparatively small ratio of expansion for the boiler pressures at which they work. Since the use of simple valve-gear seems indispensable, owing to the necessity of avoiding complications in the working of such engines, the consumption of steam per H.P. per hour is likely to remain over 20 lbs. in unjacketed engines, contrasting unfavourably with the results obtained in compound engines on land. The great expansion obtained in the "Iona" with its high efficiency is a proof of the fact that economy results from such practice. It is in all probability due to this high ratio of expansion that, though a much greater initial condensation is shown in her high-pressure cylinder as compared with the "Meteor," still the consumption of steam is less.

WEIGHT AND HORSE POWER.—It may be useful to give in Table 34 the actual weight of machinery when in working order, and the H.P. developed.

TABLE 31.—*Steam in High-pressure Cylinder (including clearance) at Cut-off and at Release.*

Steamer.	High-pressure Cylinder Jacketed or Not Jacketed.	Weight of Steam per rev.		Gain Per cent. on total feed.
		After Cut-off.	At Release.	
		Lbs.	Lbs.	Per cent.
Fusi Yama . .	Not jacketed	2·24	2·31	3 0
Colchester . .	Not jacketed	6·77	6·84	0·8
Ville de Douvres	Not jacketed	27·02	26·36	—0 2
Iona . . .	Jacketed	2·26	2·44	7·7
Tartar . .	Jacket not in use.	3·39	4·33	18·3

TABLE 32.—*Percentage of total feed present as Steam in Cylinders at different points in stroke.*

Steamer.	High-pressure Cylinder.		Intermediate.	Low-pressure
	After Cut-off.	Before Release.	Before Release.	Before Release.
Two-cyl. Compound	Per cent.	Per cent.	Per cent.	Per cent.
Fusi Yama .	N 83·1	N 88·1	—	N 70·8
Colchester .	N 72·0	N 75·2	—	N 52·7
Ville de Douvres	N 80·6	N 79·3	—	N 72·5
Triple Compound.				
Meteor . .	J 77·1	J —	J 80·2	J 75·3
Tartar . .	N 45·2	N 63·9	J 58·2*	J 60·3
Iona . . .	J 63·4	J 65·5	N 74 9	N 59·1

J = Jacketed. N = Not jacketed. * 49· at a much earlier point in stroke.

TABLE 33.—*Initial Condensation in High-pressure Cylinders.*

Steamer. High-pressure Cylinder Jacketed or Not.	Feed present as Steam at cut-off.	Range of Temperature in Cylinder.	Area of Cooling Surface.			
			Total.		Per pound of entering Steam per minute.	
			Clearance.	Barrel, up to cut-off.	Clearance.	Barrel, up to cut-off.
Triple Compound.	Per cent.	Fahr.	Square Feet.	Square feet.	Square feet.	Square feet.
Meteor, jacketed . . .	77·1	77°	—	15·40	—	4·45
Iona, jacketed . . .	63·4	81°	12·75	5·58	11·39	4·98
Tartar	45·2	54°	25·40	7·15	9·90	2·79
Two-cylinder Compound.						
NOT Jacketed. Fusi Yama . .	83·1	58°	17·30	9 84	14·66	8·34
NOT Jacketed. Colchester . . .	72·0	73°	45·20	23·54	10·92	5·09
NOT Jacketed. Ville de Douvres .	80 6	69°	84·73	47·23	6 05	3 37

TABLE 34.—*Weight of Machinery, and Indicated Horse-Power.*

Steamer.	Total weight of Machinery.	Indicated Horse-power. Total.	Indicated Horse-power. Per ton.	Net Volume of Boiler per I.H.P.
Two-cylinder Compound.	Tons.	I.H.P.	I.H.P.	Cubic Feet.
Fusi Yama . .	100	371·3	3·7	4·53
Colchester . .	395	1979·7	5·0	2·52
Ville de Douvres .	361	2977·0	8·2	2·09
Triple Compound.				
Meteor . .	309·5	1991·0	5·1	2·72
Tartar . .	291	1087·4	3·7	4·33
Iona . . .	202	615·4	3·1	4·15

Circulating Water.—Only in the last two trials made, namely the "Iona" and the "Ville de Douvres," was any measurement attempted of the temperatures of the circulating water. The temperatures of the inlet and the outlet were measured, as well as the hot-well temperature. They were as follows:—

Iona . . . . 55·8° inlet and 75·5° outlet=19·7° rise.
Ville de Douvres . 61·7° inlet and 85·0° outlet=23·3° rise.

Calculating from the heat contained in the steam at release in the low-pressure cylinder, the quantity of circulating water per pound of steam must have been 52·5 and 43·1 lbs. respectively, with 9·47 and 5·93 square feet of condensing surface respectively per pound of steam.

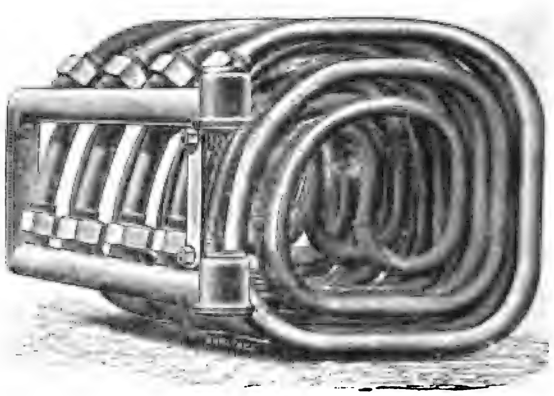
Conclusions.—A highly important point as to the possible economy of triple-compound engines the author considers still remains undecided, namely the influence of thorough jacketing. The ratio of expansion differs so greatly in the "Meteor" and the "Iona" that it is not possible to compare them in regard to jacket influence. What is wanted to determine this point is a pair of consecutive trials on the same set of engines in which all three cylinders are jacketed, one trial with none of the jackets in use, the other with all three in use. If the "Iona" engines had been thoroughly jacketed, still greater economy the author believes would have been obtained, when her great expansion is considered.

One of the chief objects of the Committee was to show that it is perfectly practicable to carry out a complete test of the propelling machinery of a steamer without interfering in any way with the ordinary working; this the author thinks has been decisively proved. Further the trial of the "Ville de Douvres" has shown that by using a meter the measurement of the feed may be made as simply and easily as the weighing of the coal. If indicator diagrams are taken at regular intervals, and fuel and feed measured over a given time, the absolute efficiencies of both boilers and engines are determined with as much ease on board ship as on land. The work of the Committee the author therefore trusts will induce shipowners to have systematic tests made of the propelling machinery of their steamers, as is now done on land by millowners and other large users of steam power.

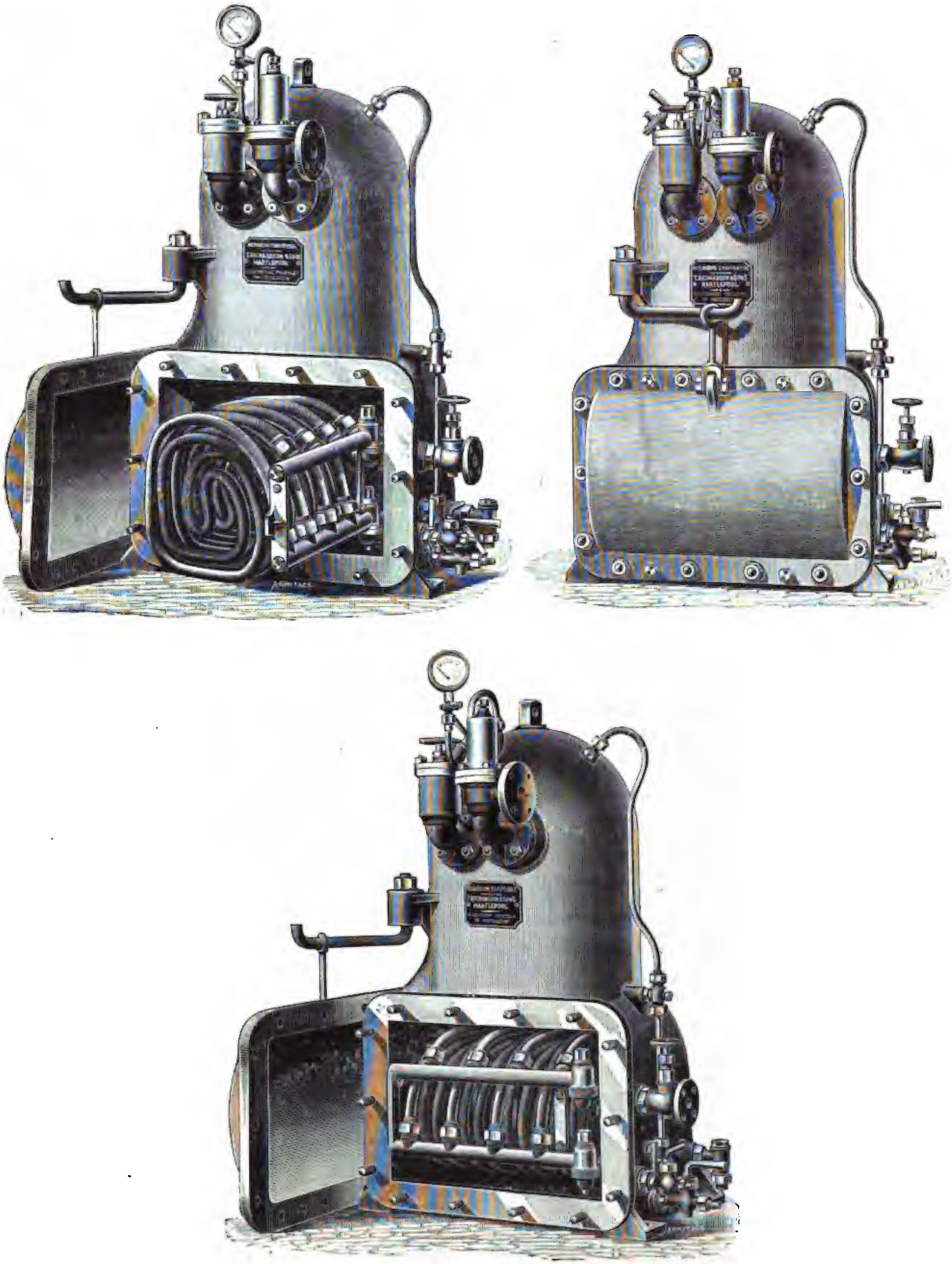
MORISON'S RADIAL EVAPORATOR.

SINCE the presence of evaporators on steamships has become an acknowledged necessity, a great many designs have been introduced, each claiming special notice as possessing features of value. A very successful apparatus of this class is that known as "Morison's Evaporator," manufactured by Messrs. T. Richardson & Sons, of Hartlepool; and this firm, acting in the progressive spirit of the age, is now introducing a new design which appears to fulfil all the requirements necessary for high efficiency. To give satisfactory results, every description of apparatus employed on steamships must be simple and handy, but this is especially the case with an evaporator, as though the expansion of the heating coils tends to throw off portions of scale, periodical examination for scaling and cleaning is absolutely essential. The evaporator we illustrate certainly possesses in a marked degree the desirable feature of handiness, and it would be difficult to arrange an apparatus in which the coils could be scaled or replaced with greater ease and rapidity. When it is considered that any accumulation of scale rapidly lessens the efficiency of an evaporator, the possibility of replacing a working set of coils by a clean spare set, becomes of great importance, especially in warships, as with such an arrangement, an apparatus of much less size and weight may be employed. The rapid decrease in the evaporative, efficiency of heating coils through scale accumulation, is, or ought to be, provided against in merchant steamers, by fitting evaporators of ample capacity, so that even when the coils are coated with a thin layer of scale, the output should still be sufficient for all requirements. Very complete experiments have, we understand, been lately made at Hartlepool, by Mr. D. B. Morison, in which sea water has been evaporated, and the exact efficiency under all conditions ascertained. Such a result must necessarily prove of considerable value, as it will permit of the output, under ordinary working conditions at sea, to be guaranteed, and will prevent the mistake —which is often made—of fixing the blame on the evaporator, if there is any failure to make up the loss caused by an unnecessary waste of water in the engines and auxiliary machinery.

As will be seen from the illustration, the heating coils are mounted on two tubes, one forming the inlet for steam, and the other the outlet for the condensed water. These terminate in sockets which fit over hollow plugs



on which they can revolve, and on which they are kept steam-tight by cap nuts. When it is desired to clean the coils, the tubes are turned on the plugs, thus bringing the entire heating surface outside the evaporator, and when it is considered desirable to replace the working coils with a spare set, all that is necessary is to lift them off the plugs and place the others on. A very simple apparatus for scaling the coils of the evaporator which has been devised by Mr. Morison may be described as a small vessel arranged to discharge a spray of steam and paraffine. The coils are revolved outside the evaporator, and the flame from the spray lamp playing on the scale causes the latter to suddenly expand, so that it is very easily and quickly removed, which operation, besides being simple and expeditious, precludes the danger of damaging the coils by severe hammering.



Morison's Radial Evaporator

DIGEST OF RECENT DECISIONS OF THE HIGH AND APPEAL COURTS OF THE UNITED KINGDOM ON SHIPPING CASES.

Proceedings against one of the Crew of a River Steamer under the Employers and Workmen Act, 1875, for refusal to obey orders.

THE respondent was one of the crew of the steamship *Albion*, which was a kind of barge exclusively used for the carriage of salt upon the rivers Weaver and Mersey, from Winford, where it was manufactured, to Liverpool, at which port it was transferred to ocean-going ships. The voyages of this steamer were on the rivers Weaver and Mersey only and so far as on the Mersey the same voyages were upon the tidal waters, and did not extend in these waters beyond the limits of the port of Liverpool. The *Albion* was registered under the Merchant Shipping Acts as a British ship in 1887, at the port of Liverpool. Her gross tonnage is 142·87 tons, and registered tonnage 102·92. Her crew consisted of three men, respectively called captain, engineer, and hand, or mate. The duties of the respondent were to obey the captain's orders in navigating the steamer, and also in tarring, scraping, cleaning the cabin, putting hatches on, working the derrick at Liverpool, and assisting at the locks, &c. He was paid weekly wages, and so much per ton winching, trip money and tonnage. No articles of agreement in writing had been entered into between the appellant and respondent, nor was he registered as a seaman. The contract of service could be terminated in a week's notice from either party, and a notice given by the respondent to the appellants was produced. As he refused to obey the order of the superintendent of the vessels and barges of the appellants to transfer himself to another vessel, proceedings were taken against him under the Employers and Workmen Act, 1875. On behalf of the respondent it was argued that proceedings could only be taken against him under the Merchant Shipping Act, 1854. The magistrates at Middlewich, in Cheshire, were of opinion that the *Albion* was a "ship" and the respondent a "seaman," according to the meaning of the Merchant Shipping Act, 1854, and consequently the appellants had no remedy under the Employers and Workmen Act, 1875, and therefore they dismissed the complaint. This decision was reversed by the Queen's Bench Divisional Court, which held that the appellants' steamer was not a sea-going ship, and therefore the proceedings were properly taken under the last-mentioned statute.—*The Salt Union, Limited, v. Wood.*

Liability of Pilot for Collision on the Clyde.

The pilot in charge of the s.s. *Strathspey* took her from the port of Glasgow down the river Clyde, when an exceptionally strong ebb-tide was running. In consequence of the strength of the current in her favour, and the slow rate of speed to which she was restricted by the river bye-laws, the pass of this steamer through the water was insufficient to give her steerage way. She therefore sheered over to the wrong side of the river and collided with the s.s. *Islay*. It is provided by the 138th section of the Clyde Navigation Consolidation Act, 1858, that a pilot "shall be answerable for any wilful or culpable neglect or mismanagement." The Court of Session of Scotland decided that the accident was owing to the fault of the pilot in taking his ship down the river when the ebb-tide was so strong that he might have foreseen the danger to which he would be exposed, and therefore that he had acted with blameable neglect, which rendered him liable for damages to the owners of the *Islay*. The Court also held that the liability of a pilot, under the before-mentioned section of the Act of 1858, was the same as at common law.—*Macbrayne v. Patience.*

Collision between Two Ships in a Fog.

It is provided by Article 18 of the Regulations for Preventing Collisions at Sea, "that every steamship, when approaching another ship so as to involve the risk of collision, shall slacken her speed, or stop and reverse if necessary." An action was brought by the owners of the s.s. *Ariel* against the owners of the s.s. *Lancashire*, for damages arising out of a collision between the two ships. The former-named steamer was one of 1,452 tons net and 2,020 tons gross register. When the collision occurred she was on a voyage from Varna to Hamburg with a cargo of wheat. The *Lancashire* was a large ship of 2,712 tons net and 4,193 tons gross register, and her cargo was about 3,500 tons deadweight, and she was on a voyage from London to Liverpool. The collision occurred in the neighbourhood of the Owers light ship in the English channel, shortly after 8 p.m. on the 10th of June, 1892. According to the evidence of the master of the *Ariel*, at about 3.40 p.m. she passed the St. Catherine's light, and her course was about E. by S., that about 4 30 it came on foggy, and her engines were reduced to half-speed; and at 4.50, when the fog became denser, the engines were reduced to dead slow. Shortly after 7 p.m. the *Ariel* was in the neighbourhood of the Owers lightship. At 8 p.m. the order was given by the captain to go as slowly as possible, and after that the speed was only two knots an hour. The master of this steamer stated that at five minutes past 8 he heard a steam whistle apparently right ahead a long way off; that this whistle was heard from time to time, and his own whistle was sounded in answer to it; and after listening for about ten minutes he ported to about E.S.E. After porting, as the ships were getting close, he heard the whistle of the *Lancashire* on his bow port. He steadied at E.S.E., and the whistle did not get any broader. About five minutes after he had steadied in the E.S.E. course, he saw the ship at about two points on his port bow a length or two off, and he therefore reversed his engines and put his helm hard aport, but was struck about 15 ft. abaft the stern on the port bow, the time of the collision being about 8.20 p.m. The *Ariel* was so much damaged that she sank early the next morning. The account given by the master of the *Lancashire* was that at 5.7 p.m. his ship was abeam of Beachy Head, proceeding on a course of N. 82 degs. W. At 6.15 fog ahead was noticed; at 6.30 he ordered the engines to be slowed, and at 6.35 he proceeded dead slow. At 7.46 he heard a steam-whistle a point or a point and a half on his starboard bow. He continued to hear this whistle and it gradually broadened on his starboard bow. He repeated the order dead slow, and the last blast before his suspicions were aroused was from two and a half to three points on his starboard bow. He then heard a whistle that made him suspicious because it appeared to come from the same direction as the previous whistle and not to be continuing to broaden. He then at once stopped his engines, his speed up to that time being about three and a-half knots through the water. He was satisfied from the next whistle that the *Ariel* was porting and closing on his starboard bow, and he therefore reversed his engines full speed. He heard two more blasts, and as the last one was dying away the *Ariel* came into sight crossing him at an angle of about forty degrees. When first seen the ship was about 150 yards off, two and a-half to three points on the *Lancashire's* starboard bow. According to the testimony of the captain of the *Lancashire* the collision took place at seven minutes past 8. Mr. Justice Barnes found that the *Ariel* was to blame for porting and not slacking. With regard to the *Lancashire* he put the following questions to the nautical assessors:—"Were the indications by the whistle from the *Ariel* under the circumstances such as to convey distinctly, to a master of reasonable skill, in the locality in which the vessels were that the two ships were so approaching that they would pass well clear of each other without risk of each other until the *Ariel* portel. The nautical assessors answered that question in the negative. Mr. Justice Barnes was consequently of opinion that the *Lancashire*, in not having slackened speed sooner than she actually did, had not complied with the before-stated article of the Regulations for preventing collisions at sea, and he therefore held that both ships were to blame for the collision. This decision was affirmed by the Court of Appeal.—*The Lancashire.*

Registration of New Transfer of Ship Sold by Mortgagee.

The mortgagee of shares of a ship sold them for the amount of the debt secured by the mortgage. A discharge of the mortgage and bills of sale in favour of the purchasers were entered at the same time on the register. These bills of sale appeared to be unlawfully executed, and in 1892 the mortgagee who had received payment of the price, granted corroborating bills of sale. These were offered by the purchaser for registration, but a claim to the shares having been intimated by the mortgagor, the registrar declined to make any further entry on the register. In an action at the instance of the buyer, to have the registrar directed to register the second bills of sale, defences were lodged by the mortgagor, who maintained that under Section 68 of the Merchant Shipping Act, 1854, the shares had again vested in him on the registration of the discharge of the mortgage. The Court of Session of Scotland held that even if the mortgagor had the formal title of the shares, the beneficial right to them belonged to the purchaser, and that to enable them to cure the defect in their formal title they were entitled to a decree ordaining the registrar to register the second bills of sale.—*Duthie v. Aiken.*

Contract by Foreigners for Salvage of Foreign Ship within the Jurisdiction.

The defendants the North German Lloyd's Co, which is a German company transacting business in Germany, were the owners of the

Eider, a German ship which stranded on the English coast within the three-mile limit. The captain of the ship, who was a German, entered into a contract in the German language with an agent of the plantiffs a Swedish salvage company, also with an agent of a German salvage company, by which the two salvage companies undertook to do their best to save the ship and her cargo, and to take her to an English port "against a salvage reward or compensation" of 50 per cent. of the value of the property in the salved condition; such value in case of difference to be ascertained by arbitration and payment to be made to the German company within ten days after the salvage was effected. The German company was to have a lien on the ship and cargo until payment of the salvage money. No place of payment was specified in the agreement, and neither the defendants nor the German salvage company had any place of business in England. The greater part of the cargo was salved and the ship was also successfully floated and taken into the English port, the salvage-money from the cargo saved was duly fixed, but as a dispute arose as to the value of the ship the amount was settled by arbitration. The plaintiffs brought an action in the Admiralty Divisional Court to recover their share of the salvage-money, and obtained an order *ex parte* permitting them to serve notice of the writ upon the defendants out of the jurisdiction, but such order was afterwards discharged on the motion of the defendants who had entered a conditional appearance. The Court of Appeal decided, in affirming the judgment of the President of the Admiralty Division, that according to the true interpretation of the contract there was no obligation by the defendants to pay the salvage-money within the jurisdiction, and therefore there was no breach of a contract that according to the terms it ought to be performed within the jurisdiction, within the meaning of Order xi., rule 1 (c), and that the plaintiffs were not entitled to an order giving leave to serve notice of the writ of summons out of the jurisdiction.—*The Eider. The Neptune Salvage Co. v. The Norddeutscher Lloyd.*

Interpretation of Valued Policy of Marine Insurance.

A cargo of maize was insured by the defendants with the plaintiffs and other insurers, to be taken from San Nicolas and from Buenos Ayres to a port in Europe. In the policy the subject matter of the insurance was described to be "26,910 bags of maize from San Nicolas, £6,065 at one per cent.; 8,299 bags of maize from Buenos Ayres, £1,878 at seven-eights per cent." A further statement was contained in the policy that by agreement the goods were valued at £7,940 included £1,361 6s. 6d. advance on freight. The policy covered all risk in craft and contained a warranty against particular average unless the ship or craft should be stranded. The 26,910 bags were shipped at San Nicolas, but while on her way down the river to Buenos Ayres the ship containing then stranded. At such time the 8,299 bags were in lighters in Buenos Ayres roads awaiting her arrival. The ship was ultimately got off and sailed to Buenos Ayres, where she was surveyed and found to be seaworthy. The cargo from San Nicolas (which had been taken out, was re-shipped, the 8,299 bags waiting in the lighters in Buenos Ayres roads, were put on board and the ship proceeded on her voyage to Europe in the course of which a large part of the cargo was damaged by water in consequence of the perils of the sea. It was admitted that a claim for particular average owing to the stranding arose as regards the bags shipped at San Nicolas, but the defendants claimed to be entitled to recover also upon the bags shipped at Buenos Ayres. They further urged that the loss should be calculated upon the full £7,940 without any deduction on account of advanced freight for the average statement. The first contention by the defendants was adopted, but not the second. The plaintiffs having brought an action to recover money alleged to have been over-fixed by them, the Queen's Bench Divisional Court decided firstly that as at the time of the ship stranding the 8,299 bags were only at risk in the craft, and not at risk in the ship the warranty attached, and the defendants were not entitled to recover a particular average loss on account of these bags, and secondly, that the policy was to be interpreted as one policy upon valued goods, and not as one by which advanced freight was separately insured and that consequently the particular average loss should be estimated upon the full amount of £7,940.—*The Thames and Mersey Marine Insurance Co., v. Pitts, Son & King.*

A dry dock, belonging to the Manchester Ship Canal Pontoons and Dry Dock Co., was opened near Mode Wheel Locks last month. The dock is 450 ft. long and 65 ft. wide.

CHAPMAN'S PATENT RECIPROCATING MOTION.

THE subject of our article is an improved means for producing a rotary from reciprocating motion, patented at the end of last year by G. Chapman, 30, Inverlieth Row, Edinburgh, and is the practical application of a very neat mathematical problem. Before describing the motion we would say that it is claimed to give a much smoother action than the ordinary connecting rod motion, whilst by dispensing with the said rod, a great economy in space occupied and also in weight is obtained.

Fig. 1 shows a drawing of the motion, whilst Fig. 2 is that of a model which we had the pleasure of seeing working in Glasgow last month. In Fig 2, AA are two cylinders, BB two piston rods, CC the guide frames. The cylinders and guide frames are placed diagonally, at right angles to one another, and the piston rods pass and repass one another during the stroke, one piston being in the middle of its stroke when the other is beginning or ending. There is a pin D working in the crosshead journals of each piston-rod, and a link E connects the two inner ends of the pins D. The outer ends are connected to the shaft F by means of links G.

The patent, as we have already said, is the practical adaptation of a mathematical law, viz.—When two ends of a line move diagonally its centre describes a circle. The pistons move diagonally crossing and recrossing each other's courses midway at every stroke, and a link, half the length of one of the rods, connects both crossheads of the pistons by a pin at each end passing through and revolving in journals, the outer continuation returning to a line with the centre of the inner one, so that they move together, the outer forming part of the crank (or cranks where there is one on each side) in connection with pistons, the circular motion causing the rotation of the connected shaft. A continuous motion is thus obtained in no way dependent on the momentum of the shaft. The diagonal movement of the two ends of the link E approximates to a parallel motion and thereby reduces the friction on the guides to a minimum. The opinion we have formed of this invention is, that as the application of a strictly mathematical movement to a practical purpose it has a very important future before it. For high-speed engines where dead points are so fatal and where a continuous rotary motion is desired it will be one of the most useful inventions for this class of work that has appeared for many years, considering that it is an entire departure from former practice. We believe from what we have seen that, as applied to paddle steamers, or broad shallow draught boats where the concentration of large power in a low vertical space is desired, it should be a distinct acquisition, and we wish Mr. Chapman every success with his patent, which he has so arduously brought to a practical issue. Messrs. Bottomley & Liddle, Glasgow, are the agents, and will be pleased to forward full particulars to any interested party.

Institution of Naval Architects.—The annual meeting of the Institution will take place on Wednesday, March 14th, and the two following days, in the Hall of the Society of Arts, John Street, Adelphi, W.C. The annual dinner will be given on Wednesday, March 14th, at the Holborn Restaurant, High Holborn, W.C., at 7.15 p.m.

Fig I

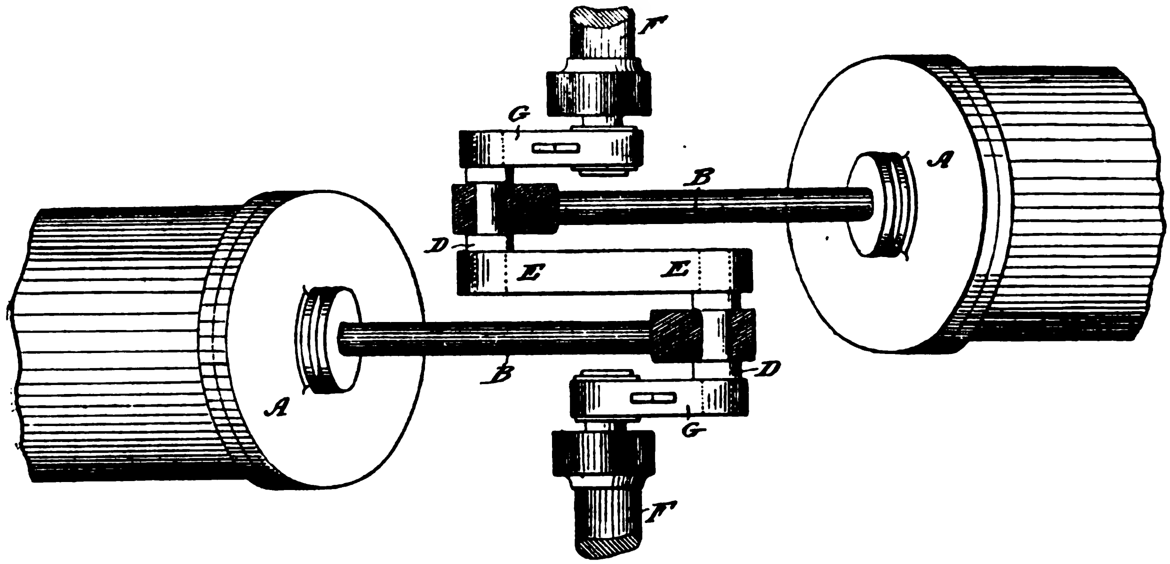
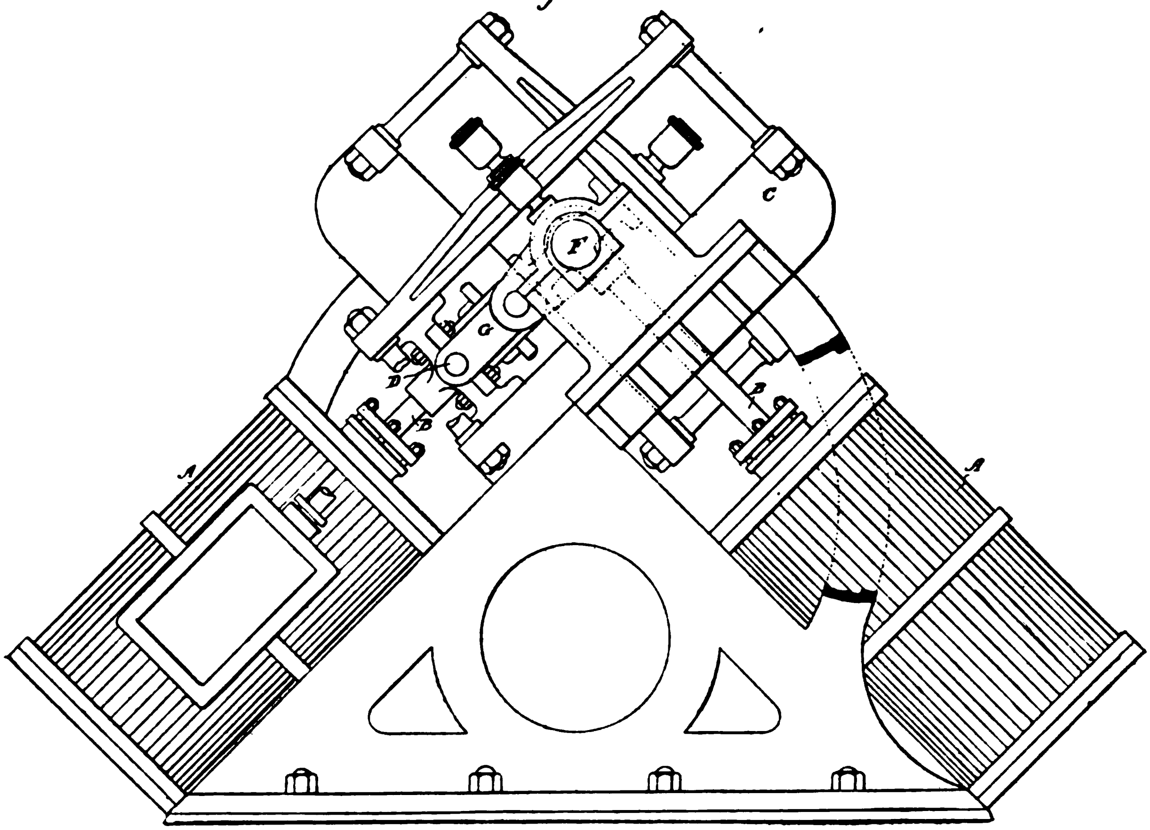


Fig 2



CHAPMAN'S PATENT RECIPROCATING MOTION (*See page* 509).

THE TRANSPORT OF PETROLEUM IN BULK.

AT the meeting of the Institution of Civil Engineers, on Tuesday, the 6th of February, Mr. Alfred Giles, President, in the chair, the paper read was on "The Transport of Petroleum in Bulk," from the point of view of minimising the risks of fire and explosion, by Mr. Boverton Redwood, F.R.S.E., Assoc. Inst. C.E.

Beginning with the question of accidents arising from transport in bulk the author stated that the few, but unfortunately serious, disasters which had attended the general adoption of the system of transporting petroleum in bulk in tank-steamships had been collectively of a most instructive character, and there was much to be gained by a critical consideration of the conditions under which they arose. Before, however, proceeding to review these, reference was made to some cases of accident not connected with this mode of transport, or in which other volatile inflammable liquids had been implicated. Many explosions and fires described had resulted from the incautious use of naked lights and fires on small vessels carrying petroleum spirit—the Regent's Park explosion affording an illustration of the danger thus created. Cases were also recorded in which the ignition of an inflammable or explosive mixture of vapour and air in benzoline stores on manufacturing premises, in public sewers, and elsewhere, had been attended by more or less disastrous consequences; and particulars were given of accidents of a similar character with carbon disulphide, methylated spirit and whisky.

Details were furnished of the principal accidents which had taken place in connection with the transport of petroleum in bulk. In the case of the s.s. *Petriana* it was shown that there was no audible explosion, but a silent ignition of oil which had escaped in a state of spray into an empty compartment. In the instances of the s.s *Ville de Calais*, s.s. *Fergusons*, s.s. *Tancarville*, and s.s. *Petrolea*, there was a violent explosion. The loss of the s.s. *Lux* was primarily due to the ignition of oil which had gained access to the boiler-space. With the exception of the first and last, these vessels carried crude petroleum, while in the two exceptional cases, the cargo consisted of refined petroleum (kerosene).

The formation and ignition of inflammable and explosive mixtures of petroleum vapour and air were next considered, the author stating that certain descriptions of petroleum evaporated freely at common temperatures; that the vapour given off was much heavier than air and might remain for a considerable length of time in any receptacle capable of holding a liquid, or might flow unperceived for some distance in a stream similar to that of a liquid; that the vapour was highly inflammable and capable of carrying back flame to the source whence it emanated; and that mixtures of petroleum vapour and air might be either inflammable (burning silently) or more or less violently explosive. It was further shown that petroleum, at temperatures below that at which vapour was freely evolved, might be converted into a highly combustible spray. Crude petroleum consisted of a great number of hydro-carbons, some of which were exceedingly volatile, and the vapour given off might be from 2½ to 3½ times heavier than air, its density depending upon the chemical composition of the hydro-carbons present. From the vapour density the volume of vapour given might be calculated, and it was thus found that one volume of a petroleum spirit consisting principally of hexane, yielded 187 volumes of vapour at 60° F. The percentage volume of the vapour of a volatile hydrocarbon taken up by air depended upon the tension of the vapour and varied with the temperature. When the vapour of petroleum was brought into contact with the air, diffusion took place, the heavy vapour travelling upwards into the lighter air and the air passing downwards into the vapour. The weight of a volatile liquid hydrocarbon which would pass into a given volume of air (up to the point of saturation) was the same as that which would volatilize into an equal vacuous space, though the evaporation into air took place far more slowly than into a vacuum, and when the air became saturated with vapour, the tension of the mixture was the sum of the tensions of the air and vapour separately. Therefore, when petroleum spirit or crude petroleum was evaporating in a partially filled tank, a large increase in the volume of the atmosphere above the liquid in the tank took place. The proportions of vapour and air requisite for the production of inflammable and explosive mixtures were experimentally determined with apparatus described, and the data obtained were set forth in the paper. The general principles governing the manner in which such mixtures behaved on ignition were also discussed. Briefly, it was found that when a volatile hydrocarbon was evaporating into air in a confined space, the atmosphere first became inflammable (burning silently) then more and more explosive up to a certain point, then less and less explosive, and finally (if sufficient hydrocarbon were present in the atmosphere), only combustible when in contact with the outer air. The conditions under which an explosive mixture of petroleum vapour and air might be ignited were investigated, and it was stated that neither the glowing end of an ordinary wooden match or of a "fixed star" vesuvian the flame of which had been extinguished, nor a red-hot coal which had ceased to blaze, nor a shower of sparks from a flint and steel or from the fireworks known as "scintillettes" and "golden rain," was capable of causing the combustion of the mixture; but a platinum wire raised to white heat by means of electricity invariably caused ignition, though at a red-heat no such effect was produced. Either the electric spark, or a flame, at once caused the explosion of such a mixture, but an inflammable mixture containing a small proportion of vapour might be ignited by a large flame when a small flame or an electric spark proved ineffective for the purpose. The use in an oil-tank of a heated rivet at a temperature below that which was requisite for the ignition of a mixture of petroleum vapour and air might nevertheless be attended with danger, owing to the ignition of the oil which remained between the plates at the laps. Particulars were given of instances of the ignition of benzoline vapour by the discharge of electricity accidentally brought about in the industrial use of the liquid for "dry cleaning," &c.

The subject of the construction of petroleum tank-steamers was next referred to and mention made of papers read before other bodies. There were, however, a few points, arising out of the accidents referred to, still undealt with. The importance of extending to the extreme height of the upper deck the cofferdams separating the oil-tanks from other spaces had now become recognised, and if there were any doorways in the 'tween-decks, in the bulkheads forming the cofferdam, adjoining the engine space, they should be fitted with doors which could be screwed up oil-tight. There was now a general consensus of opinion in favour of keeping the cofferdams full of water while the vessel had her cargo of oil on board. The oil-tanks should be completely isolated from the cofferdams and other spaces, and should therefore be fitted with a separate service of pipes and pumps. In steamships carrying volatile crude petroleum in bulk there should be provision for the safe discharge of vapour from the tanks, and tank-steamships in general should be fitted with steam-jet or fan ventilating appliances.

The precautions to be observed in the management of tank-steamships were next considered. So long as the cargo tanks of a properly constructed tank-steamship were full of oil there was very little risk of fire or explosion, except through serious structural damage resulting from collision or other accident. The accumulation of vapour in the 'tween-deck bunkers, due to leakage of oil from the expansion-trunks of the oil tanks, must however be guarded against and care must be taken that the expansion-trunks did not become overfilled or empty in consequence of increase or diminution in the volume of the oil. Even in the case of vessels carrying crude petroleum in bulk there would not be sufficient justification for any attempt to prevent smoking and the use of matches while at sea, but it was desirable that special places should be set apart for smoking and that only safety matches should be used; both smoking and the use or carrying of matches elsewhere being strictly prohibited. The chief risk occurred during loading and discharging. At such times, therefore, smoking and the use or carrying of matches of any kind anywhere on board, as well as the employment of naked lights and fires (other than the main boiler-fires, which should be banked) should be rigorously prohibited. The vessel should, except as regards the necessary marine lights, be lighted only by electric glow-lamps, the ship being carefully wired, the positions of the switch-boards being judiciously chosen and any lamps used in spaces liable to become charged with vapour being of safe construction. The tank-covers should be kept closed as much as possible, and in the case of crude petroleum, provision must be made for the safe discharge of vapour during loading or while water ballast was being taken in. Before the tanks were entered for inspection they should be ventilated, and if repairs necessitating the use of hot rivets were to be effected, the oil compartments and adjacent spaces should be thoroughly

cleansed and efficiently ventilated in the manner described in the paper, until on testing by a competent expert the complete removal of inflammable vapour was found to have been accomplished.

The paper concluded with some remarks on testing the atmosphere of tanks and other spaces. This subject had engaged the attention of the author during the past two years and a half, and details of his experiments were given. The author had experimented with apparatus for collecting and testing samples of the atmosphere of oil-tanks and other spaces. The test-lamp employed, in common with the miner's lamp referred to, depended for its action upon the formation of a "cap" over the hydrogen flame, and it was found that this "cap" was distinctly visible when air containing considerably less than the proportion of vapour necessary for the formation of even an inflammable mixture, and still less than that requisite to produce an explosion, was tested. The apparatus, the construction and mode of use of which were fully described, had been practically employed and had given satisfactory results. A delicate form of manometer which had been successfully applied to the determination of the proportion of petroleum vapour in air, was also described. The action of this instrument was due to the increase in density of air containing the vapour of hydrocarbons.

THE FLEETS OF THE MAIL LINES.

Comfort and Safety on the Atlantic.

THE year 1894 was not very old before it saw two important announcements from the White Star Line, which are certain to leave their mark on the passenger traffic of the North Atlantic. The first was the simple notification that cotton would not hereafter be carried in the passenger steamers of the line. This was doubtless in view of the numerous fires that have occurred through the dangerous methods adopted by Americans in their treatment of this inflammable commodity. This tends to the good of all. Passengers of all classes, the vessels' crews at sea, and their friends and underwriters on land will all sleep more soundly in their beds for this announcement. The next affected only the humbler class of travellers, but to them it is a boon indeed. The company will hereafter provide them free of charge with the fixings which heretofore they have in all lines had to find themselves. No more will the procession of steerage passengers to the docks be recognizable by the fact that they are really and literally departing "bed and baggage." The knife and fork and spoon, the plate and pannikin will be found now for the emigrant as the more elaborate table equipage is provided for his more wealthy fellow-traveller. This move was one that is bound to be followed by other lines. The Allan Line were almost equally prompt in commencing the new plan as the first suggestors, and two days later the Beaver Line followed, and so did the Dominion and American Lines.

The Guion Line.

This winter, as last, the Guion Line has withdrawn its boats, and rumour has on each occasion exaggerated the significance of the move. We are interested, therefore, to learn that mid-April is to see the old flag once more in the passenger service, and that the *Alaska* and *Arizona* are to maintain a fortnightly service. When they come out they will have fresh New York agents, but the old firm will manage them still in England. They, too, will furnish the steerage passengers with the paraphernalia offered by other Atlantic lines.

The Cunard Line and the Irish Ports.

Our readers have probably seen the new sailing card of the Cunard Line, which shows the latest Cunarder, *Lucania*, alongside the earliest. The *Britannia* looks merely a neat little model beside her giant successor. What strikes one on looking carefully into the drawing is that the *Lucania* is flying a *green* ensign instead of the blue which is her right in virtue of her commission as armed cruiser. Is this an accident on the part of the printer, or is there some deep significance of the attachment that the oldest Atlantic line feels to the port in the Emerald Isle that for so many years has welcomed its successive vessels?

Disasters.

This month, as is perhaps not altogether to be wondered at, when the weather we have experienced is regarded, there are a good many casualties to record. The *Chilian* has been abandoned at sea. She was once a mail steamer, having been built in 1871 for the West India & Pacific Line. Then in the following decade she was sold to Messrs. Harland & Wolff, who effected improvements in her, and ran her for a time themselves. She was finally owned by Messrs. Macbeth & Gray, of Glasgow. The disaster is attributed to injuries sustained by contact with a derelict, and, if there is any truth in the report, it should strengthen the hands of those who demand international agreement to destroy these removable dangers.

The *Paris* has had an accident. She was heretofore the only vessel that could be cited as having met with a casualty where both engines were disabled, and those few persons who are still of opinion that single-screw steamers are good enough, always relied on the disaster to the *City of Paris* (as she was then) in support of their argument that twin screws were not always capable of saving vessels from total disablement. We, personally, were never able to see that, even in that accident the twin screw did not justify its existence. Had she not had the arrangement, the single engine of 20,000 H.P. had surely, when uncontrolled, wrecked the vessel enough to sink her like a stone. But the recent disaster to this famous ship has put her experience as incontrovertible evidence in favour of the twin screw. She was westward bound when suddenly her rudder head went. The weather was very heavy at the time, and a single-screw ship, under such circumstances, would have fallen into the trough of the sea. Providing the weather continued bad, and no assistance came, one could imagine no worse predicament for a single-screw ship. It would only be a question of time for her decks to be beaten in, her fires to be extinguished and the inevitable end to follow. Doubtless this has been the fate of the National liner *Erin* and of many another staunch ship—in spite of steel decks and the cunning of the shipbuilder. They have gone and left no trace. A jury rudder is not always operative, especially with ships of vast bulk. Nor does assistance always come at the opportune moment, even in the so-called crowded lanes of traffic. But the *Paris* was not disabled by her loss. Thanks to her double screw she was able, had she had coal enough, to complete her voyage. Captain Randle was however well advised in making for the nearest port in the weather that then prevailed, and that he had every right to anticipate at the time of year. That he was able to do 14 knots and to make port without assistance speaks volumes not only for the method of duplication, but for the officers and crew of the ship.

The casualty will, however, disorganise the service of the Line somewhat, especially as the *New York* is at present at Newport News to have her overhaul.

The Castle Line.

This line has given notice that all its intermediate boats are in future to call at Southampton. So now each Saturday will see a mail steamer and an intermediate liner leave Southampton. The Union and Castle lines take it in turns to despatch one of each class. One would think this rather an *embarras de richesse*, and might think that it would be convenient if the sailing date of the intermediate vessels of each line were changed to the middle of the week, say Wednesday, so as to give a semi-weekly service to South Africa. The fact that two steamers a week sail to Capetown shows how this colony has progressed, for it is not so many years ago that a monthly service was all that the trade could support.

The *Tantallon Castle*, Sir Donald Currie's latest contribution to the South African Mail Fleets, was launched at Fairfield on the 24th January. She seems to be some 35 ft. longer than the *Dunottar Castle*, and is slightly more beamy. The great feature of the new boat (which is on the single-screw principle), is the adoption of the quadruple-expansion engine which, as we have already stated, is approved in Cramp's new vessels. It has never however been tried as yet in a mail steamer at sea. One would be inclined to imagine that the type where three cranks are used for the four cylinders—one pair being arranged tandem fashion—would be the easiest in running. But the Fairfield Shipbuilding Co., and Messrs. Cramp, having each adopted the four-crank arrangement, are probably well advised in the course they both adopt.

The West India Royal Mail Line.

were fortunate in respect of their steamer *Eden*, which went ashore at Buck Island. After nearly two months she was got off and taken into St. Thomas's. The damage she has sustained was however of a serious nature, and she is to be replaced, in the intercolonial service on which she was employed, by the company's steamer *Trent*. The *Eden* is of a couple of thousand tons gross register, and was built some twelve years ago by the Barrow Shipbuilding Co.

The announcement is made that the West India Co. are about to build another vessel of this class, and also a sister to their latest acquisition the *Nile*. One sister to that vessel is already well advanced. She will be known as the *Danube*. This must surely be the ship about whom the paragraph is written. We have no reason at present to believe that the company intends to add a third to the *Nile* class.

The old *La Plata* of this line has already been mentioned in this column in reference to a projected public yachting voyage which fell through in a disastrous and unfortunate manner. She has continued in the business under another name, and under other owners, and has, after being well puffed in the daily press, started at last on a trip.

The National Company.

The National Co. has a very doleful story to relate for the year 1893. There has been a large loss of working. This can hardly be wondered at when we regard the patriarchal age of their vessels, which, though they have gone out of the passenger trade are still confronted at the two British ports they work from, by the opposition of such splendid modern cargo boats as those of the Atlantic Transport Co., from the Thames, and of the White Star Line from the Mersey. Vessels whose coal bills and repairing accounts are heavy can never compete with modern and economical ships, even if they are written down to nothing. It is reported that the *Canada* and the *Italy* of this line are sold for about five thousand pounds each. The *Italy* was built as recently as 1870, and has compound engines of that date, John Elder & Co., being her builders. She was very nearly the first if not actually the first steamer in the North Atlantic trade to be fitted with the compound engine.

The *Canada* is some seven years older, having been launched under the name of *Pennsylvania* by Messrs. Palmer of Jarrow, in October, 1863. She was then some 340 ft. in length, and of about 2,800 tons gross register—a leviathan for those days. When the success of the *Italy's* engines was proved she was re-engined and boilered by Messrs. Laird, lengthened 50 ft., and turned out as the *Canada*, of 4,200 tons gross. She has been lying for some time in the Medway, and will be remembered as the scene of an outbreak of fire, to which reference has already been made. This reduces the fleet to eight steamers and of course helps the average age, which is now not much over twenty-one years.

New Tonnage.

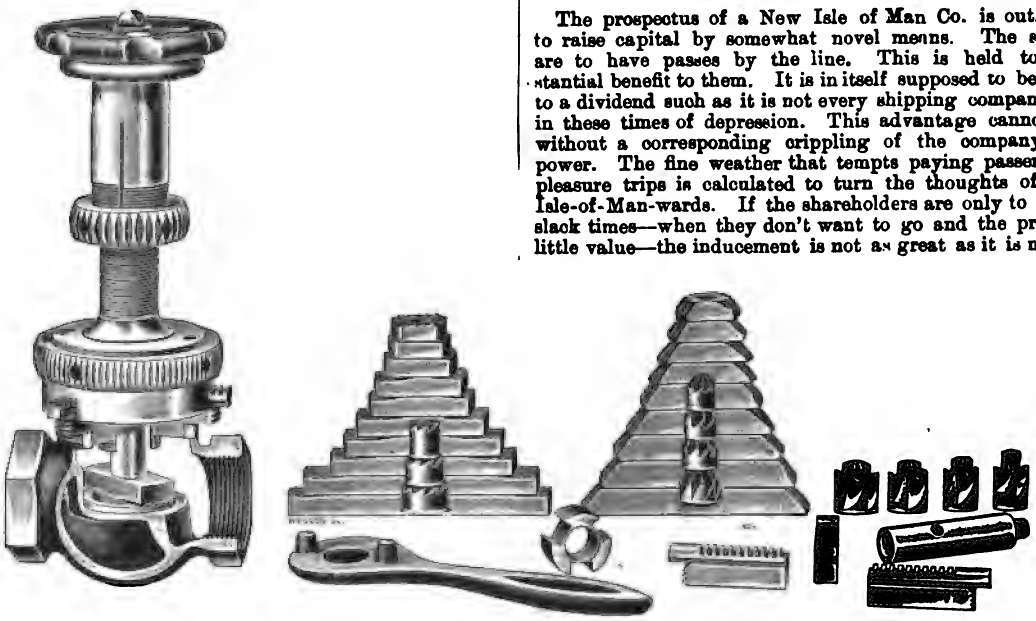
The White Star people have had their little baggage tender, *Pontic*, for use in the Mersey, launched by Harland & Wolff. She is specially designed for her work, and has twin-screw triple-expansion engines. This launch completes the work actually in hand for the line. But according to a letter from Mr. Maitland Kersey, the New York agent of the line, to the New York Harbour Board, they have very important plans in the office. These, however, depend on whether they can obtain the enlarged accommodation they require at the New York end of their route. Not content with a fleet of six cargo boats, the oldest of which is not six years old, and the latest of which is the biggest of her class now afloat, they talk of putting on a new class of larger boats for this trade. For the more important passenger and mail service they intend building something thirty-nine feet longer than the *Lucania*. But all these ideas are prevented from becoming facts by the smallness of their New York piers. We may be sure that the go-ahead New Yorkers will not let this remain a reproach to themselves, and a hindrance to their customers long.

The Peninsular & Oriental Co., who, as we have recently been reminded, require ten thousand tons of new shipping per annum to keep their fleet up to date, have also ordered a couple of seven thousand ton cargo boats.

The New Channel Steamship Line.

The prospectus of a New Isle of Man Co. is out. It wants to raise capital by somewhat novel means. The shareholders are to have passes by the line. This is held to be a substantial benefit to them. It is in itself supposed to be equivalent to a dividend such as it is not every shipping company can show in these times of depression. This advantage cannot be given without a corresponding crippling of the company's earning power. The fine weather that tempts paying passengers to go pleasure trips is calculated to turn the thoughts of deadheads Isle-of-Man-wards. If the shareholders are only to be taken at slack times—when they don't want to go and the privilege is of little value—the inducement is not as great as it is made out to be. If, on the other hand, they are to go on without restriction in the height of the passenger season, paying passengers will have to be refused in large quantities, and calculations as to probable earnings will have to be largely discounted on this account.

The Naval Construction Company, of Barrow, is to have an order to build three modern twin-screw liners for this trade. We shall await further developments with interest.



THE MORSE VALVE RE-SEATING MACHINE.

It is said that life is made up of a sum of trifles, and there is no doubt that this adage applies particularly to the care and maintenence of engineering plant. It is the wear and tear of small trifles that make up the sum of anxiety to keep everything going in good order. Amongst these trifles that we may name are screw-down valves in which leakage is one of the most annoying troubles to which engine plant and those in charge of them are exposed.

To have to take down a range of piping to remove a valve for repair or renewal because it leaks is a serious undertaking, possibly stopping the whole plant for a very trifling repair could it be done *in situ*.

We illustrate herewith a very simple appliance, together with cutters and accessories, that have been devised by that well-known inventor, Morse,

of twist-drill celebrity, and which is being imported in large numbers into England from America. It is being introduced by "The Morse Agency," of 22, Manchester Street, Liverpool, and has already been adopted by the local steamship companies, railway companies, and private firms of manufacturers, and, after an exhaustive test, by the Lords of the Admiralty.

The appliance is a self-centreing chuck which may be adapted to the body of any screw-down valve in position after removal of the valve spindle and cap, and to any size of valve from ½ in. to 12. in., in three sizes of machine.

A steel milling cutter is fixed to a spindle with hand wheel, guided by the said self-centreing chuck, and the valve seat, whether flat or taper, can thus be skimmed over, not ground by a cutting tool, until restored to as good condition as new in a few minutes. The whole repair can thus be done in the dinner hour without stopping the plant beyond that interval, and where so effective a repair can be done so quickly, it will pay steam users to always keep their valves in good order, and thus to save considerable leakage in steam, which is often allowed to go for a long period, owing to the difficulty or delay caused by repairs in the usual way.

The machine will also clean out cock seats, and, to those who know the time and trouble required to grind up a cock or valve of which the seat has been scored, the advantages of this skimming or cutting machine are obvious. It is particularly useful in regard to hydraulic valves, as it will seat these with perfect accuracy, which is difficult of attainment with the present appliances, and we understand that several eminent hydraulic engineers have adopted it for this purpose.

The valves and cocks will be made to last much longer, as they can be kept in perfect repair so long as any metal in the seat is left to skim out.

We anticipate that this machine will be soon as readily known and adopted amongst all engineers and users of steam power as the Morse twist-drills, where good and permanent work is required.

"DUROL."

A NEW hardening composition for steel, under the title of "Durol," has been used upon the continent of Europe, and judging from the testimonials given, we should think, with considerable success. As "Durol" is now being put upon the English market, it may interest our readers to have some information on the subject. In using the hardening composition for tools, a fire free from wood or sulphur, such as a coal fire, ought to be employed. The steel is brought to a dark red heat, then it is dipped in "Durol" for ten to twenty seconds, after which it is heated slowly until it is cherry red, and then cooled directly in tepid water. An ordinary drill, for instance, treated as above, two or three times, obtains such an amount of tenacity, elasticity and temper, that file-proof armour-plates, hard castings, &c., may be drilled with it, without the aid of any lubricant, or without any centering being performed first.

Steel plates, armour plates, heavy hammers, anvils, &c., may also be hardened in the above-named manner; the vessels, however, used for that purpose must be constructed in such a manner that all the parts of the tool which are to be hardened are completely covered by the hardening ag[illegible] "Durol." The same remarks apply to parts of engin[illegible] bushes, boxes, sockets, pins, pivots, beari[illegible] wheels and pulleys; and also to tools—li[illegible] tools, drills, augers, chisels, hot chis[illegible] cutters, cutting files, rams, block-ha[illegible] tools, matrices, gravers, scrapers, com[illegible] [illegible] jaws, tongs, file-cutters, chisels and tobacco knives, pipe cutters, plate shears, clamps, &c., &c.

Tools which are exposed to a blow or a stroke must be allowed to "blue" as required when tempering with "Durol." Before dipping the steel, whether in "Durol" or in water, care must be taken that it is perfectly clean, *i.e.*, free from slags or cinders; in fact, the object which is to be hardened or tempered should be wiped quickly before each dipping in "Durol" or in water. In cases where tools have to be forged first, the "Durol" must be forged in with the steel, the fire being kept high in order to prevent the steel from coming into direct contact with the blast. It is claimed that "Durol" is of the greatest service in cases where long cylindrical objects are to be turned, or large surfaces to be planed, and where everything depends on the tenacity of the tools. Further, steel that has been overheated can always be used again, when tempered and forged in with "Durol." The sole importers and licencees for the United Kingdom and the Colonies are Messrs. William Holz & Co., 78, Bishopsgate Street Within, London, E.C.

FORGING BY HYDRAULIC PRESSURE.

AT the meeting of the Institution of Civil Engineers on Tuesday, the 20th of February, Mr. Alfred Giles, president, in the chair, the paper read was on "Forging by Hydraulic Pressure," by Mr. R. H. Tweddell, M.Inst.C.E.

The paper commenced by a brief history of the development of the hydraulic forging-press since the year 1846, when the late Sir Charles Fox proposed the attachment of different tools for the working of hot or cold iron to the tables of the Bramah press. The author then formulated the following conditions as necessary to be fulfilled to ensure success in hydraulic forging: first, the press must be so proportioned as to ensure the utmost rigidity, any movement of the main columns, of course, interfering with the correctness of the work; secondly, the crane-power must be not only ample, but so arranged that weights reaching to 100 tons could be manipulated by unskilled labourers; thirdly, the details of the construction of such parts as the valves and pumping arrangements must be as perfect as possible. These conditions were discussed seriatim, and the author indicated the means by which they were met in the various types of forging-presses now made. Proceeding to particular makes of press the paper gave descriptions of all those at present manufactured in England. This part of the paper concluded with a reference to the 22-hundredweight steel ingot exhibited in the 1851 Exhibition by a Sheffield firm, the size of which was then considered quite exceptional; and by quoting Fairbairn's opinion of the value of the steam-hammer in building up large masses of iron for the manufacture of large guns and marine-engine shafts.

The second part of the paper was devoted to a comparison between the hydraulic forging-press and the steam-hammer. Starting with the axiom that noise and waste of energy were convertible terms, the author mentioned the points in which there could be no difference of opinion as to the superiority of the press. Its power was practically all exerted upon the forging and not dissipated in shocks to the framing and foundations; it also occupied much less headroom than a hammer, and consequently travelling-cranes could be used, passing, if necessary, over the press. Further, not only could more work be turned out by a press than by a steam-hammer in a given time, but it could work through a much greater range, for while the effects of a "blow" shortened the life of any of the dies or tools used, it rendered impracticable the employment of numerous dies and moulds which were satisfactory under pressure. The art of forging large masses had made distinct advances since the introduction of hydraulic pressure; for it was formerly impracticable to forge the hollow marine shafts at present used, or to draw out gun-tubes or hoops on the mandril.

It was extremely difficult to draw the line where the tools described ceased to be forging-presses and became stamping [illegible]ng machines. Here, there was no more room for [illegible]s to the merits of forging-press *versus* steam-[illegible]use many interesting questions arose as to the [illegible] a blow or a steady pressure when, for instance, [illegible]work used in [illegible]. The author had [illegible]ne himself [illegible]ulic forging-press [illegible]ate the m[illegible]nt of metals by [illegible]s a wh[illegible]ght had been

expended in trying to calculate the size of hydraulic press that would be equal to a steam-hammer exerting a given force of blow, but in the opinion of the author the question was not worth pursuing, because until the amount of work done on the forging was equal and done in the same space of time no satisfactory comparison could be made. Owing to the action of the hydraulic press being constantly progressive the tool continued to free its way into the ingot until its resistance to alteration of form was equal to the pressure on the ram, or the latter was removed. In this it differed entirely from the action of a hammer which, having delivered one blow, did no more work until the following one. This constituted the essential difference between the two machines. The effect of the hammer was momentary, and there was not time for the pressure it gave to penetrate the metal, much less to alter its form to any extent at one blow, but in the hydraulic press the same rate of working per hour could be maintained, while the material was allowed every opportunity to flow in the required direction without injury. The effect of hydraulic pressure on forgings was to increase their homogeneity. The blow of a steam-hammer was given with least effect when it was most required, that was, it could not get its full stroke until the forging was reduced in size, whereas the press gave its full power at any point in its stroke.

The paper was accompanied by an appendix giving a detailed account of each of the forms of forging-press alluded to in the text: by a note of Mr. Charles Davy, of Sheffield, comparing a press and a hammer doing nearly equivalent work; and by an account of some experiments by Mr. Coleman Sellers, of Philadelphia, on the number of hammer-blows and the amount of hydraulic pressure required to deform similar test-pieces to the same extent.

FLUCTUATIONS IN THE ENGINEERING TRADES FOR THE LAST THIRTY-FOUR YEARS.

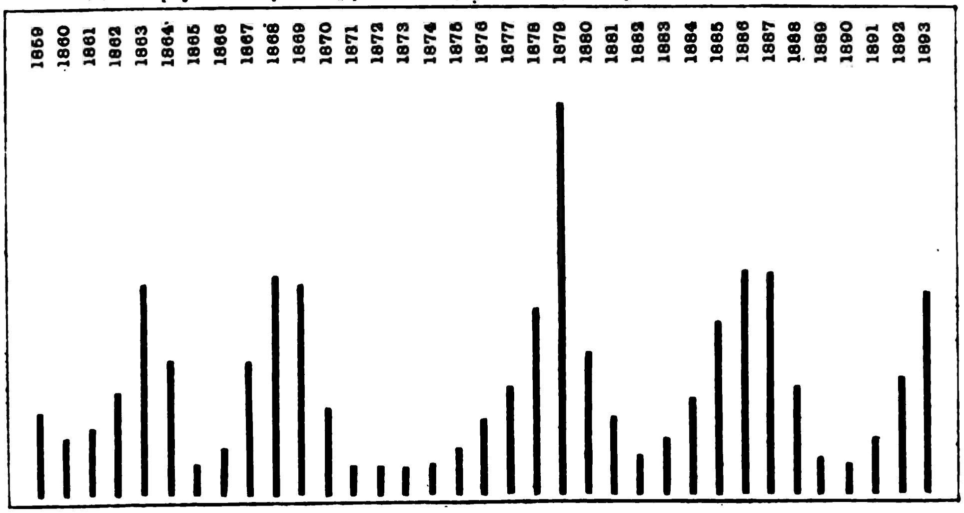
THE following extract from the Sixty-ninth Annual Report of the Steam Engine Makers' Society, will be interesting to our readers, as showing from one reliable source of information the fluctuations which have taken place in the engineering industries of this country, so far, at any rate, as employment is concerned, which may be taken as a fair index of the actual state of trade during the last thirty-four years. Mr. James Swift, the General Secretary to the above Society, in the course of his introductory address, says:—

"The question of an improved trade is one anxiously canvassed by many honest workmen at the present time. As some guide to the future prospects in this direction, we have prepared a code or diagram of the rise and fall in trade, so far back as our Monthly Reports give the number of members unemployed. In preparing this code we have taken the average number out of work each year from 1859, and on a scale of one-sixteenth of an inch for each quarter per cent. out of employment, with the result that it can be seen at a glance the good and bad trade that has prevailed in the past thirty-four years. The result cannot but be striking to see the even ebb and flow of trade as gauged by the unemployed list taken from reliable figures and not based on theory. One point that is noticeable is that when trade has been good for an extra period the depression is equally acute afterwards; whilst another point is that the present age is not visited by longer or more severe periods of bad trade than those of our ancestors. The record of 1879 is a proof of this, and the gaunt figure in the code towers double the height of any succeeding year, and, as a consequence, there was double the misery, as those of us who were members at the time have cause to recollect.

"The code clearly shows that bad trade has been as prominent in past years as it is at present, whilst the older reports of the society give evidence that it was even worse in periods prior to 1859, but no actual figures are given. In those days machinery had not made the progress it has in the present generation, whilst emigration to foreign lands was then resorted to as an outlet. All this is now changed, and whilst machinery has, in a great number of cases, displaced skilled labour, the emigration theory has ceased to be advocated. To do so now would be cruel, as the evidence from the Australasian Colonies and America goes to prove that they are far worse off for employment than in this country, and, in a measure, the same may be said of the continent. The result is a general unrest of labour, with demonstrations of unemployed the order of the day, and rash language used as to remedies to effect a change. This course, however, is not generally adopted by the *bona-fide* unionist, for, having a society to which he has a financial claim, he can remain passive, knowing that whilst these claims will be met, the first opportunity will be taken to render him help to a situation by the society's influence. To regulate employment in all seasons is a problem that much theory has of late been expended upon, but until we can regulate the climatic influences we are afraid it will be a long time before a code can be issued showing one continuous limited number out of employment.

"One important factor to improve these conditions is combination, and that of a *bona-fide* nature, to regulate the various trades. The efforts of such societies to increase their members is now universal, and, as so often expressed, one object to be aimed for at the first opportunity is a general reduction of working hours. To attempt to force it in the present state of trade would be futile, but the signs of the times all point to the fact that the eight hours is now within measurable distance. Already several firms in the engineering trade have

Code or Diagram showing the rise and fall in the Engineering Trade from 1859 to 1893, as guaged by the percentage of Unemployed Members in this Society. The Scale is compiled at the rate of $\frac{1}{16}$ of an inch for each quarter per cent Unemployed. Example.—$10\frac{1}{4}$ per cent Unemployed in 1879, and $\frac{3}{4}$ per cent in 1890.



voluntarily conceded it, and up to date have not failed, as was prophesied by opponents. The concession of the Government to their employés at Woolwich Arsenal will give an impetus to the movement, and possibly lead to others voluntarily giving the same consideration at an early date, whilst those who are persistent in their refusal will ultimately have to be taken into consideration."

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our own Correspondent.)

THERE is no longer any doubt that the Government have come to the opinion that it will not do to baulk the country in its desire for an augmentation of naval strength. Mr. Robertson, the Civil Lord of the Admiralty, said, indeed, at Plaistow, that so far as the department to which he belonged is concerned, there had all along existed a determination to increase the fleet, and to cope with those other matters, the supply of *personnel* and docks, but it is to be feared that without the agitation of outsiders Lord Spencer might have wanted in vain. The actual programme will not be revealed until the Estimates are laid on the table of the House of Commons, and then only so much of it as refers to the building programme of 1894-5. This is an arrangement to which the country should plainly intimate its objection. The excuse put forward by Mr. Robertson is that if the programme is revealed it will at once form the standard up to which France and Russia will build. But, so far as this is concerned, everything will depend upon whether those nations deem it possible or profitable to attempt to rival us. If our programme is such that it will show once and for all that we have no intention of placing our supremacy on the sea in question, then, instead of operating in the manner in which Mr. Firnord describes, it will have a diametrically opposite effect. A programme which is not made public may just as well not exist, and if ministers persevere in their intention it is pretty certain that the naval agitation will continue.

War Ships or Fads?

Naturally a good deal of curiosity is aroused as to what manner of ships the new programme will be composed of. Some of the battleships, it is known, will be of the *Magnificent* class, but there are also rumours that some smaller armourclads are to be built. Naval men are very anxious that these should not be some novel and untried class. There always exists a desire for exploiting strange and odd monsters for war purposes at sea. The craze is not confined to civilians, for naval officers get bitten with it at times, and then too they have it badly. In nearly all the various proposed programmes, which have been given to the world recently, these fancy battleships are to be found, whether they are drawn up by trained professionals like Lord Charles Beresford, or inexperienced speculators like "H." of the *Daily Graphic*. But the sea service, as a body, regards them with aversion and distrust. The *Polyphemus* is a fad, so is the *Northampton* and the *Hecate* and her sisters. They are useless, because they are "neither fish, flesh, fowl, nor good red herring," and consequently are always square pegs in round holes. The European nations waste money in submarine boats in the same way, and the United States on naval rams of the *Ammen* or *Katardhin* type. In this country a course is very plain. We should stick to battleships, cruisers, and torpedo-boat destroyers, and, in class, set forth the requirements from a naval point of view, as a first step, then letting the naval architect fix the displacement to suit those requirements. To begin to reckon from the point of view of cost or size must be a mistake when it is recalled that a fleet which is insufficient for its work is the most expensive fleet we can possibly have.

Portsmouth Dockyard.

It does not yet appear to have been finally settled whether three battleships are to be built here, or two, but it is very certain that the new programme will give us plenty of work, since more than 500 tons of material are being delivered here every week, and this is apart from what is sent in for the *Majestic* and the *Eclipse*. The first keel plates of the former vessel were laid in No. 13 dock, on Monday, February 5th, and it is stated that she will be ready for launching in eleven months. As this is the only dock at Portsmouth, in which a vessel of this size can be built, it is evident that not very much progress could be made with another vessel if begun here when she takes the water. The third ship (No. 4), of which there is talk, will probably be built on No. 5 slip, where the *Eclipse* is now building, and where in times past the *Imperieuse* and *Royal Arthur* were put together. Perhaps the second ship (No. 8) will not be 15,000 displacement, in which case a different arrangement may be made. In any event there is plenty of work here, the *Royal Oak*, *Revenge*, and *Repulse* to complete, the *Sultan* to rebuild, several smaller craft, and a good number of the *Havock* class of torpedo-boat destroyers to prepare for commissioning. The *Repulse* is to be fitted with bilge keels by way of experiment, and will go into the North Lock Dock for the purpose. There is not much prospect of the *Water Witch* being finished by March, as much remains to be done before she is ready, when she will go to Australia on surveying service. The *Centurion* and *Crescent* have been commissioned here, and the *Melpomene* has paid off, while it is rumoured that the *Endymion* and *St. George* will shortly hoist the pennant.

Bilge Keels and Docks.

It is a curious reflection that the rolling of the *Resolution* should have raised the question of the need for putting bilge keels upon her and her sisters, and that this should have drawn attention to the scarcity of docks. It has now been decided to try the experiment of fitting bilge keels to the *Repulse*, one of the ships of the *Resolution* type, and she made a series of trials before being so fitted, and made another series with them on her. Of course, bilge keels will not prevent an unstable ship from capsizing, but then the stability of the ships of the *Royal Sovereign* class is vouched for by more than one independent expert: what they will do is to lessen the tendency to roll, and excessive rolling is the defect of these vessels. But Mr. White was perfectly well aware that if he put bilge keels on these ships they would not be so liable to wallow about like a cask; why then did he design them without these useful adjuncts? The answer is, that he did not so design them; but when the arrangements for building were gone into, it was found that the docks must be enlarged, and that practically there are not three in the Government yards capable of receiving these vessels with bilge keels fitted to them. The Admiralty fought shy of the expense, and so now it is left for the present Board to enlarge the docks and add the keels. At Portsmouth there is only one building dock available for a ship of the *Majestic* class, and there is the lock dock, which is the waterway to the repairing basin where the *Repulse* will be fitted with bilge keels. At Chatham there is only one suitable building dock, and at Devonport and Pembroke there are none.

Ships Commissioned or Paid off.

The largest ship commissioned in February was the *Centurion* which, on the 14th, hoisted the flag of Captain Edmund S., Poë, at Portsmouth. She carries a complement of 670 officers and men, and is going to China to take the place of the *Imperieuse*, which vessel Captain Poë will bring home. The new flagship is a much more formidable vessel than her predecessor and Vice-Admiral the Hon. Sir Edmund Fremantle is to be congratulated on having such a splendid craft under him during the concluding twelve months of his command in these waters. On the 20th February the *Crescent*, first-class cruiser, was commissioned at Portsmouth to carry out new crews to the *Orlando* flagship, and several other vessels on the Australian station. The intention in selecting the *Crescent* for this purpose is to give an opportunity for trying her speed and sea-going capabilities. She will run out and home again economically, but be back in time for the mobilisation in June. The *Æolus*, *Spartan* and *Skipjack*, all of which ships were commissioned in January, have proceeded to the Mediterranean, the two former as additional cruisers and the latter as an additional torpedo-gunboat. The *Audacious*, guardship at Hull, has been paid off at Chatham and the *Edinburgh* has taken her place; a similar exchange between the *Superb* at Greenwich and the *Dreadnought* when she comes home will be carried out. The *Tyne* has taken out new crews to Bombay for the *Maralton* and *Lapwing*; and the *Tamar* to Hong-Kong for the *Porpoise*, *Rattler* and *Firebrand*. The *Melpomene* which arrived at Portsmouth on January 23rd, from the Pacific, paid off at that port on February 14, she was commissioned on 17th June, 1890.

The Sub-division of Battleships.

At Malta, recently, Captain A. K. Wilson lectured before the newly-started Naval and Military Society on the subject of "Improvements in the Sub-division of Battleships suggested by the Loss of H.M.S. *Victoria*." Captain Wilson advocates the abolition of the longitudinal bulkhead and the armoured deck, and the substitution for the present watertight doors, of small doors as high up in the transverse bulkheads as possible, and these only where absolutely necessary. He also condemns the present system of ventilation in battleships, where huge air trunks pass low down through all the principal bulkheads in the ships. He suggests that the main ventilating pipe should pass high up through the ship, fore-and-aft, and should have branches leading down to the different compartments. He also advocates the use of air-pumps for pumping air instead of fans, these to be capable of use if necessary for forcing sufficient air into a compartment to keep the water out of it in the event of its being pierced. During the discussion which ensued some officers suggested that high angle firing would be deadly to a ship without she possessed an armoured deck; but the sense of the meeting appeared to be that high angle firing would not be sufficiently accurate to do much damage. Captain Wilson exhibited two models, one representing the internal structural arrangements of the late *Victoria*, and the other his own ideas. By experiments with weights he capsized the *Victoria* model, but his own, though similarly pierced, did not sink. The lecture was listened to with great attention and interest by a large audience of naval and military officers, and will be reprinted in the proceedings of the new society.

Devonport and Keyham.

It is expected that the new programme at these yards will comprise a second-class cruiser of the *Talbot* class and two new gun vessels of the *Torch* class, these with the *Talbot* which is to be laid down now the *Harrier* has been launched, will occupy four out of our five slips at Devonport. The question has again been raised about the insufficiency of dock accommodation and also further facilities at Keyham in the way of enlarged machinery shops. Of the ships of the old programme, the following are to be completed here before the end of March, the *Bonaventure*, already passing into the Fleet Reserve, the *Astræa*, nearly ready, the *Cambrian*, recently arrived from Pembroke, the *Antelope* gunboat, which has just made satisfactory trials, and the *Hazard*, which is expected from Pembroke very shortly. We shall then have in hand of the old programme, the *Hermione*, cruiser, for which an additional sum has been granted, and the *Harrier*, *Hussar*, and *Halcyon* gunboats, all the boilers and machinery for which has been delivered from the contractors, Messrs. Hawthorn, Leslie & Co. Other vessels in hand here are the *Northumberland*, *Phæton*, and *Sybille*, *Undaunted*, *Spanker*, and *Sharpshooter*. The *Bonaventure*, which was to have gone to Australia, will not now be commissioned until the time of the manœuvres. The *Forth* has been replaced in the Fleet Reserve, her repairs having been effected and a trial having shown that there were no leaks. The *Resolution's* repairs have cost less than £225, so that they could not have been very serious. The refit of the *Prince Albert* has been postponed to allow those of the *Undaunted* and other ships to be pushed on.

The Belleville Boilers.

The trials of this type of watertube boiler, as fitted on board the *Sharpshooter* at Devonport, have begun, and have so far been satisfactory. The largest war vessels yet fitted with this boiler is the 18 knot French cruiser *Milan*, but it is also fitted in the s.s. *Armand Behic* and *Polynesien*, two of the French Australian passenger vessels. The engines of these vessels indicate about 10,000 H.P. each, and their very fast runs to Australia and back having attracted the attention of the Admiralty officials, a naval engineer was ordered to take passage in the *Polynesien* to Australia and to return in the *Armand Behic*, noting the actual results and character of the steaming power of the vessels and the working of their boilers. The officer's report was so favourable that it was decided to fit Belleville boilers to the *Powerful*, and subsequently, in the absence of another suitable type, to the *Terrible*. The boilers will be made in England by Messrs. Maudslay, who are agents for the patentees, Messrs. Delaunay Belleville & Co. At Devonport a very exhaustive series of comparative trials will be made with the *Sharpshooter*, fitted with the Belleville boilers, and the *Spanker*, fitted with those of the Du Temple type.

New Torpedo Boats.

The ten new torpedo boats, varying in length from 140 ft. to 145 ft., and in breadth from 14 ft. 3 in., to 14 ft. 9 in., which were ordered from private firms for the Navy in the fall of 1892, are now nearly all in the water, and are to be completed by April 1st next. The minimum trial speed of these boats is to be twenty-three knots, but it is anticipated that several of them will exceed this rate. Some are being fitted with the dry-bottomed locomotive type of boiler and others with different varieties of the water-tube type. They will carry in addition to three torpedo tubes, three 3-pounder Hotchkiss quick-firers. One of these boats, No. 93, built by Messrs. Thornycroft, has been delivered at Chatham, and naval officers who have seen her report that she is a great improvement on the last batch of torpedo boats. Although they will not be so fast as some of the Continental boats, they are likely to surpass anything of the kind in sea-keeping powers. They will be tried in the manœuvres next autumn. Thornycroft has two more in hand White and Yarrow three each, and Laird Bros., one.

Palmer & Co. v. the Leeds Forge Co.

Some interest will be excited in naval engineering circles, says the writer of "Naval Notes," in the *Globe*, by an action that is about to be tried between Messrs. Palmer & Co., of Jarrow-on-Tyne, and the Leeds Forge Co., relative to the supply of furnaces for the boilers of the second-class cruiser, *Pique*, at Devonport. Mysterious cracks developed themselves just a year ago in the furnaces of the *Pique's* boilers, almost immediately after she had undergone most satisfactory steam trials. The faulty furnaces had to be removed and replaced, and, by special arrangement, this work was executed at Keyham. A furnace of the *Retribution* is now similarly defective, and Messrs. Palmer, after in vain trying the effect of a patch, were ordered by the Admiralty to renew it. Hence the law suit.

Chatham Dockyard.

One new battleship is all that we expect to get here of the new programme when it comes out. That with the *Magnificent*, now building in No. 7 Dock, the *Minerva* building in No. 2 Dock, and the completing work in hand, will give sufficient employment to the yard. The new ship will be built on a slip, for there is no dock available for another ship of the size. There are four large dry docks over 400 feet long, but only one is used for building purposes. The north and south locks of the repairing basin were to have been used as docks, but their foundations are not considered sufficiently trustworthy to allow of their taking in very heavy vessels. But there is plenty of space in the extension where docks might be built. The two new vessels are making a good show already, and upwards of 900 men are at work on the *Minerva*. The *Forte* and *Dryad* have also made rapid progress; the latter is ready for her trials. The *Barfleur* has all her guns aboard, and will be in the Fleet Reserve by the end of March. Of older vessels, the *Monarch's* refit is nearly complete, and that of the *Agincourt* quite; the former has new engines and boilers, the latter new boilers only. *Blenheim* has received her new q.-f. guns, in place of the 6 in. she was originally armed with. The *Sappho*, which has also received her q.-f. guns, is being prepared for a commission in the West Indies, and the *Scylla* is under examination and refit. The *Grafton*, it is reported, will be commissioned for service in the Channel Fleet. The *Skipjack* and *Niger* have departed, but their places have been taken by the *Hebe*, *Renard*, and *Onyx*, all of which torpedo gunboats are now in the Fleet Reserve. The *Landrail's* refit is complete, the *Raven* is brought forward on the pennant, and the *Triton* is under repair. The induced draught trials in the *Gossamer* are still progressing.

Naval Personnel.

Along with the demand for more ships, there has arisen one for more officers and more men, and to supply these is a problem which does not admit of so easy a solution. The lists of commanders, lieutenants and engineers are all below the actual peace requirements of the Navy; but to increase them very largely will bring with it a host of disadvantages to the unfortunate officers in the junior grades. The desideratum is to increase the available numbers without increasing the regular lists, and this is best done by passing through the Navy a certain number of officers of the Mercantile Marine, who, having acquired some experience of men-of-war service, will return to the Merchant Navy with a retaining fee and the liability to be recalled in case of war. There have been reports that a

number of reserve officers and men were to be passed straight into the regular service, but such reports may be dismissed without a second thought as opposed in any way to the policy of the Admiralty Board. What is more probable is a slight increase of the regular lists by the usual means of acting. The Naval authorities have decided to grant £300 yearly towards the students' recreation fund, at the Royal Naval Engineers' College, Keyham. This fund has hitherto been supported by the students, each of whom, on entering the college, has paid an entrance fee of 7s. 6d., and during his stay an annual subscription of £2. This grant, which commences in April next, will enable the committee to reduce the entrance fee to 5s. and the annual subscription to £1. The students have to thank Capt. T. B. Triggs, of the R.N.E. College, for this boon, that officer having suggested the matter to the Admiralty.

The Fleet and Dockyard Reserves.

It is seldom that there has been such a powerful and numerous squadron of ships in the Fleet Reserve, practically ready for sea, as at the present time. An enumeration of these vessels that a comparison may be made with a similar list next year. The initial letters after the name of each ship shows the port at which she is stationed. Battleships: *Swiftsure* (P.), *Agamemnon* (D.), *Ajax* (C.), *Shannon* (D.), *Achilles* (P.), *Temeraire*, (D.), *Bellerophon* (D.), *Iron Duke* (P.), *Belleisle* (D.), *Benbow*, (C.), *Hercules* (P.), *Triumph* (D.), *Cyclops* (C.) *Gorgon* (D.), *Hydra* (C), *Conqueror* (D.) *Hero* (P.), *Hotspur* (C.) Cruisers: *Crescent* (P.), *Undaunted* (D.), *Endymion* (P.), *Blenheim* (C.), *Gibraltar* (P.), *Grafton* (C.), *Northampton* (C.), *Naiad* (P.), *Medea* (C.), *Bonaventure* (D.), *Indefatigable* (P.), *Retribution* (D.), *Intrepid* (P.). *Andromache* (C.), *Apollo* (C.), *Thames* (D.), *Pique* (D.), *Latona* (P.) *Iphigenia* (P.), *Rainbow* (D.), *Brilliant* (C.), *Tribune* (C.), *Thetis* (C.), *Iris* (P.), *Pearls* (D.) *Terpsichore* (C.), *Medusa* (C.), *Sappho* (C.), *Scylla* (C.), *Forth* (D.), *Emerald* (P.), *Cordelia* (P.), *Inconstant* (D.), *Conquest* (D.), *Wild Swan* (D.), *Basilisk* (C.), *Acorn* (C.), *Icarus* (C.), *Pylades* (C.), *Raven* (C.). Gunboats: *Spider* (D.), *Circe* (C.), *Gossamer* (C.), *Grasshopper* (C.), *Jason*, (C.), *Sheldrake* (C.), *Salamander* (C), *Hebe* (C.), *Renard* (C.), and *Onyx* (C.). There are also in the Dockyard Reserve, and building.—Battleships: *Repulse*, *Revenge*, *Royal Oak*, *Barfleur*,, *Agincourt*, *Northumberland*, *Sultan*, *Monarch*, *Majestic*, *Magnificent* and *Renown*. Cruisers: *Phæton*, *Sybille*, *Theseus*, *Fox*, *Eclipse*, *Astræa*, *Hermione*, *Forte*, *Charybdis*, *Cambrian*, *Minerva*. Gunboats. *Antelope*, *Halcyon*, *Harrier*, *Hussar*, *Dryad*, *Speedy*, *Alarm*, *Hazard*, *Jason*, *Jasseur*.

Torpedo Boat Destroyers.

The *Speedy* and the *Havock* are two small crafts, which at the present moment are attracting a great deal of attention. They have both been temporarily commissioned for experimental purposes, and it is understood that the *Speedy* will be eventually attached to the Channel Squadron as a tender, but in the meanwhile will make a series of trials of her water-tube boilers in the Channel. The *Havock* has been at Portland, and making runs between that port and Portsmouth for the purpose of testing her sea-going and other capabilities. Naval officers speak highly of her manœuvring powers owing to the excellent steering gear with which she is supplied. There are now six of of these boats on the water, as in addition to the *Havock* and *Hornet*, launched from Yarrow's, the *Lynx* followed the *Ferret* afloat at Laird's on January 24th, and the *Daring*, launched at Thornycroft's in November last, was followed by the *Decoy* from the same yard on February 7th. The *Hornet* has been making runs for speed, and it is believed that she will easily attain 30 miles an hour. The *Ferret* has already accomplished 26·8 knots, beating, it is said, the *Havock* record. It is, however, the later boats to whose performances more importance attaches, for they are fitted with water-tube boilers, of the pattern patented by Messrs. Yarrow & Thornycroft. In the *Decoy*, steam, for a pair or four cylinder triple-expansion engines of 3,500 I.H.P. will be supplied by water-tube boilers, on the Thornycroft principle, working at a pressure of 210 lb. per square inch. The contract speed is 27 knots.

Pembroke Dockyard.

The contract for engineering the *Renown* battleship, which is now filling up its shed at a great rate, has been awarded to Messrs. Maudslay, Sons & Field. I have said that great progress has been made on the *Renown*, but it is not possible to say exactly what amount of progress. Until recently, it was customary, when building a new ship, to exhibit on a board at the head of the vessel a summary of her dimensions, characteristics, &c., and to indicate from day to day the number of tons built into her. For some reason or another this practice was first discountenanced by the authorities and then forbidden, although no great secret was made about the matter. It was supposed that the rivalry which has grown up, not only between the Government establishments, but between them and the private yards, had something to do with this change; but now still more rigid instructions have been issued on the subject. Not only are the quantities not posted, but very careful and thorough precautions have been adopted to prevent their becoming known. The real reason for this is now supposed to be that the authorities intend to revert to the old custom of keeping ships long on the stocks, and have no intention of allowing their game to be divulged by a weekly report upon the exact progress made. The *Hazard* was launched here on February 17th, and will go to Devonport to be completed by the end of this month. The *Flora* is making good progress, and bids fair to be a cheaper built boat than the *Cambrian*.

Machinery Trials.

The *St. George*, the last of the nine first-class protected cruisers of the Defence Act has made her trials. She was constructed and engined by the Earle's Shipbuilding Co. of Hull. The trial was with natural draught, about ·09 in. of air pressure, and the horse-power developed was 10·536 or considerably over that demanded by contract. She was flying light so that the average speed attained, 20·2 knots, is probably deceptive. The *St. George* was not subjected to a forced draught trial. The cruisers *Spartan* and *Æolus* has made three hours' natural draught trials on commissioning. In the case of the *Spartan*, the results were:—Mean steam in boilers, 146 lbs.; vacuum, starboard, 27·5 in., port, 27 in.; revolutions, starboard, 130·4, port, 130·4, air pressure, ·26 of an inch; I.H.P.; starboard, 3,440, port, 3,780, total, 7,220; speed by log, 18.5 knots. In the case of the *Æolus*, the results were:—Mean steam in boilers, 142 lbs.; in engine room, 139 lbs.; vacuum, starboard 27, port 27·4 in.; revolutions, starboard, 131·4, port, 132; I.H.P.; starboard, 3,655, port, 3,759, total, 7,414; air pressure, ·2 of an inch; speed by log. 18·25 knots. It is curious therefore that although the H.P. realized in the case of the latter vessel more than that of the former the speed attained was less. The *Antelope* gunboat, whose satisfactory trials at Plymouth were reported briefly last month, made a run to Falmouth and back on her forced draught essay, with an air pressure of 1·35 in.; and I.P. of 3,621 horses was realised, and a speed of 19 knots. There was a nasty sea and the conditions were unfavourable for the trial, but the contract was exceeded and even more power could have been obtained if desirable. The *Antelope* is now to be completed for sea-service.

Measured Mile and Passage Trials.

At the recent meeting of the Institution of Mechanical Engineers, Mr. W. H. White, the Director of Naval Construction, in the course of his speech, remarked that in the Royal Navy measured mile trials were made under the most favourable conditions; and it was objected by some that a result obtained by a *tour de force* was no fair criterion of what the ship would do in actual practice. He said that they were not intended to be; but in this way, by means of measured mile trials made under, as nearly as possible, constant conditions, a valuable standard was obtained, by which the performance of vessels in any given class could be gauged. In order to test the maximum continuous sea-going speed that ships with modern machinery are capable of maintaining with the stokers in three watches, the Admiralty have directed that passage trials of not less than forty-eight hours' duration are occasionally to be made, and the best results possible should be obtained under the condition that the authorised natural draught power is not to be exceeded at any part of the trial. To obviate the necessity of disturbing the stokers off duty, assistance is to be obtained from the deck hands to bring the coal into accessible positions if necessary.

Sheerness Dockyard.

The *Rambler* has been prepared for another term of surveying service, and will probably go to the American station. Her overhaul and repair was somewhat delayed by the necessity for refitting the *Hearty*. The *Satellite*, which has been here some time, was rather hurriedly commissioned at Chatham, and has left to relieve the *Garnet* in the Pacific. Nearly all the torpedo gunboats have now been transferred to the Fleet Reserve, the *Onyx*, *Renard*, and *Hebe* being the last, while the *Speedy* has been commissioned. The *Onyx* has had her tubes ferruled, but even

this fact scarcely accounts for the two years and three months which it is now since she was laid down. The *Hazard* and *Dryad* were originally to have been built here; and although they were sent to other yards, their torpedo and electrical gear is being made in the yard. The *Leda*, one of our gunboats, is to be commissioned like the *Niger*, to relieve the *Grappler* in the North Sea, and it is anticipated that the *Grasshopper*, *Sheldrake*, and *Jason* will be commissioned for the same purpose. The proposal to provide each of the coast guard ships with a gunboat of the type, as a tender, was originally made by the *Army and Navy Gazette*.

The torpedo gunboat *Hazard* was launched at Pembroke Dockyard on the 17th February, the christening ceremony being performed by Miss Fitzgerald, a daughter of Captain C. C. P. Fitzgerald, R.N., the Superintendent of the Dockyard. On February 20th, the torpedo gunboat *Harrier* was launched at Devonport, the christening ceremony being performed by Miss Douglas, a daughter of Captain A. L. Douglas, R.N., A.P.C., of the *Cambridge*, the gunnery school at that port. These gunboats are of the type of the *Dryad* recently launched at Chatham; they are improvements on the *Niger* class, have a displacement of 1,070 tons, and an estimated speed of nineteen knots. The *Hussar* will be launched in March, and then only the *Halcyon* will remain on the stocks, the sole survivor of the N. D. Act. The *Talbot* will be laid down at Devonport, on the slip vacated by the *Harrier*. The *Dryad's* trials will take place early in March. Her keel was laid on April 23rd, 1893, and it is anticipated that she will be completed for sea by April 23rd, 1894. Her powerful machinery has been supplied by Messrs. Maudslay, Sons & Field.

OBITUARY.

It is with extreme regret that we have to record the death of Mr. John Tait, Chief Engineer of the Queensland Royal Mail Steamer *India*, which took place in London, just after the arrival in port of that vessel from Queensland. Mr. Tait was the premier chief engineer of the British India Co., having entered their employ over thirty years ago. By his death the British India Co. has lost a faithful and worthy servant, whose greatest aim and object was to weigh well his employers' interests and act with a singleness of purpose to their advantage in the important duties entrusted to him. He was one of the early members of the Institute of Marine Engineers, and took a very warm and active interest in its operations, having been the first member of its small committee who met and deliberated on the advisibility of starting what has grown and developed into a recognised and influential body.

In recognition of his deep interest in the affairs of the Institute, of his personal worth, and notably of the fact that Mr. Tait showed his thorough practical faith in the possibilities within reach of the early promoters and organisers, by placing the first sovereign on the table to assist in covering the initial expenses—he was elected the vice-president. His name will long be remembered by his many friends and his memory will long remain green; he was esteemed and loved in life, and his influence and example remain on record. He has passed away at the comparatively early age of 63 years, but during that time he has travelled over the mighty deep many thousands of miles. He loved the sea and clung to it till the last, and though he had a presentiment of failing health before the last voyage, he had enjoyed robust health up to that time and had resolved to stop on shore after one more voyage. His loss will be keenly felt by a large circle of friends and acquaintances to whom his sterling qualities had endeared him; by whom also deep sympathy is felt for Mrs. Tait and her family in their sad bereavement.

Electric Search Lights on the Manchester Ship Canal.—Messrs. Baxendale & Co., electrical engineers, of Manchester, have entered into arrangements with the Manchester Ship Canal Co. to undertake the lighting of vessels navigating this canal during dark, and they are providing in readiness at all times at both the Eastham Locks end of the canal, and the Manchester Docks complete portable electric plants for this purpose. These plants comprise a small engine and dynamo combined, search light projector of the Admiralty pattern, with which the rays of light are projected ahead of the vessel and shielded from the eyes of the captain and pilot, and mast arc lamp, with requisite staff of men for working the same. The apparatus is of similar type as that which has been used for the last twelve months by their own staff for lighting vessels through the Suez Canal, and where it has proved most effective and in every way satisfactory. With this search light, which is guaranteed of 40,000 to 50,000 candle-power, the canal, banks, buoys, locks, &c., can be clearly distinguished three-quarters of a mile ahead of the vessel, and for coaling at night, or tying up, entering locks, docks, or moorings; they are also providing a powerful electric mast lamp of 8,000 candle-power. No alteration of the ships is necessary when using this electric plant, the steam being taken from a temporary joint off one of the winches not in use, and the plant can be quickly connected up.

Engineering Trade Section.—A meeting of this body was held at the Offices of the London Chamber of Commerce, Botolph House, Eastcheap, London, E.C., on Monday, February 12th, at 3 p.m., Mr. W. J. Fraser in the chair. The question of the Antwerp International Exhibition, 1894, was brought prominently before the meeting, with a view to inducing the members of the section and the trade generally to exhibit. It was stated that the Exhibition was a very promising one, as Antwerp was an important seaport, visited by merchants and all classes from all parts of the Continent, and within easy reach of England; that the duties in Belgium were low; that it was under Royal patronage; and that a joint committee, representing the Mansion House and the London Chamber of Commerce, was acting in London in the interests of the British Section. After an expression of opinion, it was proposed by Mr. Fortescue Flannery, J.P., seconded by Mr. A. Brenner, and carried unanimously:—"That in view of the great progress recently made by engineering science on the Continent, and the prominent and accessible position of Antwerp as a site for Exhibition, the Engineering Section of the London Chamber of Commerce cordially recommends the forthcoming Antwerp Exhibition to the general support of the engineering and allied trades throughout the United Kingdom." It was then proposed by the chairman, seconded by Mr. Brebner, and carried unanimously:—"That the chairman of this section, Sir Edward H. Carbutt, Bart., be requested to confer with the Exhibition authorities as to the appointment of jurors for the engineering section." A vote of thanks to the chairman concluded the meeting.

Anti-fouling Composition.—It may interest our readers, as an example of the growth of trade in the above composition, to know that during the last quarter of 1893 Messrs. Suter Hartmann & Rahtjen's Composition Co., Limited, received returns for a tonnage of 1,155,305 reg. tons of shipping which had been coated with their composition during that period. This tonnage refers only to their composition for ships' bottoms. In addition thereto a large amount of tonnage in various parts of the world was painted, returns of which have not yet been received. Their anti-corrosive grey paint for inside protective purposes is not included in this total.

Institution of Engineers and Shipbuilders in Scotland (Graduate Section).—The monthly meeting of this section of the above institution was held in the societies' hall in Glasgow, on February 6th; Mr. M. Taylor Brown, president, occupied the chair. The discussion on Mr. P. F. Maccallum's paper on "Internal Combustion Engines" was resumed. In response to questions, Mr. Maccallum gave some further interesting particulars of the novel form of coal-burning internal combustion engine described in detail at the previous meeting. A paper on "Carriage-way Pavements," by Mr. Ambrose H. Thomson, London, was read and discussed. The meeting terminated with the customary vote of thanks.

Another Dredger for Russia.—Messrs. Wm. Simons & Co., of Renfrew, have just received a contract for another powerful dredger for the Russian Imperial Government. Besides having a large lifting capacity with its buckets, it is to be provided with special pumping appliances by which the dredged material may be raised from the hopper of the dredger and discharged through pipes on shore. The builders have two other powerful hopper dredgers in course of construction for the same Government. These will soon be ready for launching. Noticeable progress is being made with the 1,250 ton combined bucket and pump hopper dredger this firm have in hand for the Danube European Commission.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from January 25th, 1894, to February 20th, 1894:—

Andrew, G. E. (probationary) assistant engineer, has been confirmed as an assistant engineer in Her Majesty's fleet.

Apps, William R., engineer to the *Penelope*, additional, temporarily, to date January 25th.

Ash, Herbert G., assistant engineer to the *Pallas*, to date January 29th.

Austen, E. J., chief engineer to the *Intrepid*, to date January 27th.

Baker, J. G. L., chief engineer to the *Thetis*, to date February 22nd.

Barnett, Horatio S., assistant engineer to the *Marathon*, to date January 1st.

Bermingham, Cecil H. A., assistant engineer to the *Archer*, to date January 29th.

Blake, A. V., engineer, has been promoted to the rank of "Chief Engineer" in Her Majesty's Fleet.

Blake, Albert V., chief engineer to the *Cordelia*, to date January 1st.

Block, Robert J., assistant engineer to the *Centurion*, to date February 14th.

Brown, Thomas F. (probationary) assistant engineer to the *Centurion*, to date February 14th.

Brown, William J., chief engineer to the *Brisk*, to date February 17th.

Burstow, Hugh, fleet engineer to the *Inconstant*, to date February 1st.

Carruthers, Daniel J., assistant engineer to the *Ringdove*, to date January 1st.

Cleave, Thomas W., assistant engineer to the *Severn*, to date January 29th.

Collins, Charles H., engineer to the *Stork*, undated.

Coomber, Thomas G., staff engineer to the *Ringarooma*, to date February 22nd.

Dalrymple, J. H., engineer to the *Jasuer*, to date February 16th.

Donohue, Robert U., engineer to the *Pembroke*, additional.

Graham, W. J., engineer to the *Grasshopper*, to date February 22nd.

Grant, Arthur R., assistant engineer to the *Revenge*, to dato December 15th.

Gregg, Charles G., assistant engineer to the *Pallas*, to date January 29th.

Griffin, D., chief engineer, has been advanced to the rank of staff engineer in Her Majesty's Fleet.

Guyatt, Edward G., engineer to the *Lapwing*, undated.

Gyles, D. J., fleet engineer to the *Magdala*, to date February 1st.

Hammond, H. T., staff engineer to the *Leander*, to date January 27th.

Harding, R., staff engineer to the *Hecla*, to date February 1st.

Harris, Herbert W., engineer to the *Repulse*, to date February 13th.

Hardwick, William W., engineer to the *Conquest*, to date February 1st.

Hatelie, David, engineer to the *Swift*, to date February 1st.

Herbert, R. K., engineer to the *Royal Oak*, to date March 19th.

Hibbard, John A., engineer to the *Acorn*.

Hinks, F. H., engineer to the *Ringarooma*, to date February 22nd.

Hockley, S., chief engineer to the *Medea*, to date February 22nd.

Hurst, Isaac E, staff engineer to the *Marathon*, undated.

Hutchings, F. H., assistant engineer to the *Speedy*, to date March 20th.

Jones, Richard W., engineer to the *Lynx*, to date January 27th.

Laughton, Charles, engineer to the *Redpole*, to date February 15th.

Leahy, William P., assistant engineer to the *Conquest*, to date January 1st.

Lonnon, William, staff engineer to the *Porpoise*, to date February 1st.

Meaden, Nicholas, fleet engineer to the *Mildura*, to date February 22nd.

M'Gregor, William, engineer to the *Firebrand*, to date February 1st.

Mitchell, Walter F., assistant engineer to the *Centurion*, to date February 14th.

Moore, C. A., engineer to the *Salamander*, to date February 22nd.

Moore, Walter L. (probationary), assistant engineer to the *Raleigh*, to date January 25th.

Moorehead, Herbert B., assistant engineer to the *Rupert*, to date February 15th.

Morris, O. A., assistant engineer to the *Blanche*, to date February 16th.

Murray, George W., engineer to the *Icarus*, to date February 1st.

Pallett, W. H., engineer to the *Speedy*, to date March 20th.

Paris, Victor de, assistant engineer to the *Superb*, to date February 1st.

Fitt, John, fleet engineer to the *Centurion*, to date February 14th.

Pring, F., assistant engineer to the *Mildura*, to date February 22nd.

Raffey, James, engineer to the *Centurion*, to date February 14th.

Rampling, Henry J., chief engineer to the *Charybdis*, to date February 7th.

Ramsay, G., engineer to the *Blanche*, on recommissioning.

Rattey, William, assistant engineer to the *Inflexible*, to date February 13th.

Rolle, Absalom P., engineer to the *Royalist*, to date January 27th.

Shorey, C. E, engineer to the *Ringarooma*, to date February 16th.

Sparkes, Henry P., engineer to the *Porpoise*, undated.

Stansmore, Henry C., fleet engineer to the *Melpomene*, to date February 15th.

Sutton, Francis J., assistant engineer to the *Leander*, to date January 29th.

Tilbrook, C. F. H., engineer, has been promoted to the rank of chief engineer in Her Majesty's fleet.

Tilbrook, Charles F. H., chief engineer to the *Skipjack*, to date February 1st.

Turner, Henry J., engineer to the *Crescent*, to date February 14th.

Walton, J. H., chief engineer, has been advanced to the rank of staff engineer in Her Majesty's Fleet.

Watson, James H., engineer to the *Marathon*, to date January 1st.

Webster, George P., engineer to the *Victory*, supernumerary, to date January 27th, and to the *Basilisk*, to date February 7th.

Westbrook, Walter S., assistant engineer to the *Centurion*, to date February 14th.

White, A. F., assistant engineer to the *Revenge*, to date March 19th.

Whitmarsh, Alfred, assistant engineer to the *Victory*, additional, to date January 27th.

Williams, W. K., engineer to the *Blanche*, on recommissioning.

Wilson, W. A., assistant engineer to the *Aurora*, to date February 22nd.

HOAR & BROWN'S HARDWOOD MARKET REPORT, FEBRUARY 20th. 1894.

Teak.—While the amount of general business transacted remains limited, prices again show a slight improvement, and it is encouraging to find that the despondent tone which has so long prevailed is gradually giving place to the belief that better times will be seen before long. Reports from other trading circles are more cheerful, and the business now done appears to be on a healthy basis.

Orders for steamer shipments have been placed somewhat freely owing no doubt to the realisation of the fact that prices have touched bottom, and the increased enquiry caused thereby.

The large Admiralty order must also have a very strengthening effect upon the market during the coming spring.

There has also been considerable enquiry from the Continent, which emphasizes the opinion that the long period of depression from which this trade has suffered is about to end.

Mahogany.—The market is very weak throughout, and the continued depreciation in values is making the prospect serious for stockholders, but the deliveries for the month have been unusually good, showing that the extremely low quotations are encouraging manufacturers to adopt mahogany in place of other dearer woods which have generally been in use.

Cedar.—Some good business has been done lately, and fair

prices obtained. There are no large parcels expected to arrive in this market and values are likely to be maintained. Boat building logs are in good demand and difficult to get.

Sequoia.—A fair business can be done at reduced prices, but while other woods are ruling so low there is little chance for shippers reaping any benefit with further importations.

American Walnut.—Logs. Some large parcels have arrived, rendering it difficult to place anything inferior unless at very low figures. There is a fair demand for well-made logs of mild character at good prices.

The board and plank trade is quiet.

Whitewood.—Nothing of any importance has been done lately and prices have declined.

Oak.—Later shipments have shown an improvement in quality, which, with lower quotations has resulted in a fair amount of business.

Rosewood.—The market is unusually dull, stocks are ample, and prices lower than have been known for many years. There is no sign of any improvement.

Padouk.—The stock is quite sufficient to assist a steady trade, but should shipments continue to arrive the market will be strained and prices depreciated.

Greenheart.—Trade is very quiet. There is enough here to supply what is wanted and quotations remain low.

INDUSTRIAL AND TRADE NOTES.

THE CLYDE AND SCOTLAND.

(From our own Correspondent.)

During the past month there has been a continued improvement in the marine engineering and allied industries, and a very considerable amount of new tonnage has been booked. In the west of Scotland, during the month of February at least 60,000 tons of new shipping has been placed, bringing the aggregate for the new year up to the date of writing, to not less than 120,000 tons. The placing of such a large quantity of tonnage has had the effect of causing a considerable rise in the prices of materials, whilst it has been the means of inducing most of the yards here which were on three-quarter time for some time back, to go on full time again, and in some yards additional men are being taken on. In our January issue we stated the tonnage on hand at 180,000 tons, and as most of the 120,000 tons freshly booked will be launched during the present year, even though no more orders are booked for some time, the output will be higher than last year. On the 8th inst., Messrs. Denny's workmen went on full time, whilst on the following day at all the yards on the upper reaches of the Clyde full time was started. On the 10th, Messrs. Caird & Co., Greenock, extended their hours from 7 to 8½ per day, whilst on the same date the other yards at Greenock went on full time. As usual, for the benefit of our subscribers, who are interested in the details of orders placed we give a full list and it will be noticeable that the average size of the vessels placed is one of the largest we have ever seen. At the end of last month Messrs. R. MacKill & Co. placed a contract with Messrs. Connell & Co., Scotstoun, for a steamer of 5,500 tons carrying capacity, the engines being supplied by Messrs. D. Rowan & Son, Glasgow.

Messrs. D. & W. Henderson at the beginning of this month booked an order for a steel screw steamer 300 ft. long, with a carrying capacity of fully 4,000 tons. The vessel, which is for Messrs. J. & R. Young & Co., of Glasgow, will be supplied by her builders with powerful triple-expansion engines. The Ailsa Shipbuilding Co., at Troon, have received an order from Barrow-in-Furness for a vessel measuring 165 ft. by 25 ft. by 12 ft. 3 in. Two orders each for steamers over 4,000 tons have gone to a firm on the south side of the Clyde, and a third of 5,350 tons carrying capacity has been arranged for with Messrs. Russell & Co., Port-Glasgow. The Fairfield Co. have secured an order for an intermediate steamer for the Cape service of the Castle Line, and other two steamers of 4,000 tons capacity have been fixed, though we have been unable to ascertain the name of the builders.

Messrs. Maclay and MacIntyre, Glasgow, have entrusted Messrs. Alex. Stephen & Sons, Linthouse, with the contract for a steamer of 3,800 tons. Messrs. P. Henderson & Co., Glasgow, have contracted with Messrs. Wm. Denny & Bros., Dumbarton, to build a steamer of 4,500 tons.

It is understood that the Fairfield Co., in addition to the Castle liner above mentioned have booked an order for two torpedo catchers of the *Havock* type. The vessels will be 200 ft. long, and have a speed of 27 knots per hour. Messrs. J. Reid & Co., Whiteinch, have booked an order for a large passenger steamer for the west coast of South America, and they are rumoured to have got the contract for a small cargo steamer. The contract of the month however was one for two steel screw steamers for the Peninsular and Oriental Steam Navigation Co., placed with Messrs. Caird & Co., Greenock. The new steamers, will carry 7,000 tons deadweight each, and have triple expansion engines for a speed of 13 knots per hour. This about embraces all the contracts placed on the West coast of Scotland, and on the East orders have also been plentiful. Messrs. Donald and Taylor, Glasgow, placed an order for a shallow draft steel screw steamer of 3,700 tons capacity, with the Grangemouth Dockyard Co. Messrs. Scott and Co., Kinghorn, were entrusted with orders for two large and powerful steamers, and Messrs. W. B. Thomson and Co., Limited, Dundee, booked a powerful screw steamer of 1,000 tons register for the Clyde Shipping Co. One or two enquiries are still about, and amongst others the Russian Naval Department have invited tenders for two military transports, one ice-breaker, and ten torpedo boats. It is rumoured that an order in connection with this has been placed on the lower reaches of the Clyde.

A large amount of old tonnage has changed hands lately. Messrs. Maclay & MacIntyre, of Glasgow, have bought the steel screw steamer *Rutherglen* from the Caledonia Steamship Co., Limited, of Liverpool, for £18,500. She is 2,462 tons gross and 1,618 tons net register; carries 4,300 tons deadweight.; was built at Newcastle-on-Tyne in 1889, and classed 100 A1 at Lloyd's; has triple-expansion engines of 300 N.H.P.; cylinders, 23 in. 38 in. and 62 in.; stroke 42 in. Her dimensions are:—Length 312 ft.; breadth, 40·1 ft.; depth, 24·8 ft. A Glasgow firm have purchased the iron barque *Chanaral*, now lying at Rotterdam, for about £1,300. She is 553 tons register, and carries 930 tons deadweight; was built at Sunderland in 1862, and classed *A1 at Lloyd's; passed No. 3 survey in 1888. Length, 168·7 ft; breadth, 27·6 ft.; depth, 19·3 ft. She is the same size but two years older than the barque *Carrizal*, which vessel was recently bought by Messrs. Wm. Blair & Co., of Glasgow, at £1,475. The Glasgow-owned schooner *Finnart*, 77 tons register—dimensions, 72·1 ft. by 18·4 ft. by 9·4 ft., built at Rothesay in 1857, has changed hands at £100. The s.s. *Garry*, 606 net register, belonging to the North Sea Steamship Co., Limited, of Dundee, has just been sold through Messrs. J. and R. Young & Co., Glasgow.

The two small steamers recently built by Messrs. Mackie & Thomson, Govan, for Messrs. Andrew Weir & Co.; Glasgow, have been sold by that firm.

One of the most interesting events of the year in connection with shipbuilding on the Clyde, was the formal opening on the 7th inst of the new "Castle" slip dock, owned by Messrs. Blackwood & Gordon, Port-Glasgow. We mentioned this work some time ago as a sample of this firm's "go-ahead" principles, and it is our hope that it will be largely taken advantage of by shipowners who should hasten to recognise any builders who so pluckily supply a longfelt want. The slip is fully 700 ft. in length, and is laid down as an extension to the east of Messrs. Blackwood & Gordon's existing premises, and in close proximity to their wet dock, shipyard, and boiler shop, and engine-works. The under-water portions of the ways are carried on piles at close intervals, and the upper portions are laid on strong concrete walls, built on the natural bed of clay and sand forming the foreshore of the river. The slip is approached by the deep-water channel which was formerly the main thoroughfare for Clyde shipping. The body of the carriage, including main girders, side girders, and side arms, is of steel throughout, and is mounted on chilled cast wheels placed at close intervals. Special provision has been made for paddle-steamers of large total breadth, a clear space of 80 ft. being given between the side walls of the slip cutting. The hauling-up machinery consists of a 7 in. plough steel wire rope (having a breaking strength of 200 tons) wound on a drum 6 ft. in diameter and 10 ft. long. This drum is carried on an 11 in. shaft, and is securely fastened at one end to a heavy cast-iron spur wheel 12 ft. in diameter, 5 in. pitch, and 15 in. face. Gearing into this wheel is a pinion 2 ft. 4 in. diameter, and on the end of the shaft that carries this pinion is a worm wheel 6 ft. in diameter, which in turn gears into a steel worm drawn by a triple-expansion engine, designed and patented by Mr. W. Carlile

Wallace, the engineer partner of the firm. Spur gearing is introduced between the engine and worm shaft, having a fast and slow speed, so that a light ship can be hauled up in a shorter time than a heavy one.

The foundations of the slip and machinery are all designed for a total weight of vessel of 1,000 tons. As long as the weight does not exceed 800 tons, the wire hawser will be single and directly connected to the carrriage, but for the greater weight the hawser is led round a pulley attached to the carriage, and back to an anchor at the head of the slip. The whole of the work connected with the slip has been designed and carried out by the firm themselves, who in points of difficulty have had the invaluable assistance and guidance of Sir William Arrol. The first steamer hauled up was one of the Clyde Shipping Co.'s tugs, but yesterday afternoon the screw steamer *Navigation*, an iron vessel of 1,558 tons gross, and fully 1,200 tons actual weight, owned by Messrs. Raeburn & Verel, Glasgow, was hauled up in presence of the company assembled. After this ceremony the company met at a banquet in the model-room of Messrs. Blackwood & Gordon.

The joiners strike on the Clyde which has been so disastrous, but which we hoped had been amicably settled, has been threatened again, and the matter is in the meantime being considered by Sheriff Berry, whose judgment will be given by the time this appears in print. The result is we think a foregone conclusion, and we have little doubt the prospect of trade will have the desired effect of conciliating masters and men, as a strike now would be most disasterous to all Clyde industries.

In the beginning of these Notes we mention the improvement in the steel and iron trades. Their strengthened position may be seen from the prices quoted. For steel plates £5 12s. 6d. is asked, and for angles £4 15s., while about the middle of December business was done at £5 5s. and £4 10s. respectively. Best bar iron, which a month ago was £5 10s. is now £5 15s., and a little more even has been paid; and iron plates, which not long ago were £4 17s. 6d., are now £5 12s. 6d., all, of course, with the usual discounts. Steelmakers report that they are well booked ahead, and are running to their utmost capacities. Malleable ironworkers are busy, and merchants advise that enquiries are numerous. Owing to the large amount of steel now used here, and the absence of iron scrap a quantity of that material has been shipped at New York for the Clyde, and more is expected. This is the first transaction of this kind ever recorded.

The annual meeting of the British Corporation for the survey and registry of shipping was held in the directors' room of the Merchants' House, Glasgow, on the 5th inst., Mr. Nathaniel Dunlop presiding. In his remarks the Chairman said—This is the fourth annual meeting of the British Corporation. We have now completed the third year of our official existence, and our first as a society possessing rules for the construction of ships and engines. Our register book is recognized as the most completely descriptive of any hitherto published. The progress of our association has been decided and gratifying, although not all who desired and expected. Its fuller development has been hindered partly by the delay that occurred in the issue of our building rules, owing to the death of the head of the technical staff, partly by depression in shipping, and partly, also, by what is incidental to all new registers, the circumstance that it takes time to make their merits sufficiently known among traders and underwriters to inspire in these perfect confidence. Within the last few weeks we have had most gratifying testimony borne to the character of the building rules of our association. Some of the foremost shipowners and shipbuilders of the day have made our rules the basis of their building specifications, several of them classifying with us alone. During the past week the underwriters of Glasgow, recognising the value of our classification and building rules, have issued a recommendation from their directors that vessels holding our class should be regarded as of equal standing for insurance purposes as those of the highest of Lloyd's Registry. This important step cannot be too widely known. One of the merits of our register and building rules is that, while they provide detailed directions and scantlings according to the most approved practice of the day, they lend themselves to and encourage improvement in the design and structure of ships. In this connection we have had the gratification of being chosen by Messrs. Wm. Doxford & Sons, of Sunderland, to aid them in the development of their new idea of turret ships, a type of ship that bids fair in the future to hold a high position among cargo-carrying British vessels. Already a number of ships of this type have been built under our supervision. They have proved successful, and a number more will follow. Regarding our progress, I have to report that already we have assigned load lines to considerably over a million tons of shipping, and vessels are classed with us whose united tonnage also considerably exceeds that figure. A number of ships are presently building exclusively to our rules, a larger number of sets of machinery to the same, and a still greater number of ship are being built to the double class Lloyd's or Bureau Veritas and our own. The technical staff of the British Register, the leaders being high-class men in their profession, are ever ready to lend their skill to shipbuilders and shipowners with a view to the production of improved types of ship. Our special rules, as I have said, furnish at the same time a standard form in accordance with the most advanced ideas in British shipbuilding. As the symbols by which the classification of our register is known do not, without explanation, convey the meaning which they represent, we are urged by shipowners and shipbuilders to alter these, so that the character of our ships as expressed by symbols may be more easily understood, and this matter is under the committee's consideration. Already we have resident surveyors at the chief centres of shipbuilding, and we hope in ithe not distant future to establish branches of the management n the leading ports of the kingdom, so that its direction may be somewhat decentralised in comformity with modern ideas. I trust, now that we are entering upon renewed activity in shipbuilding, and that there is hope of reviving trade in shipping, that shipowners and builders will take heart and in larger measures extend their support and countenance to the British Register. It is peculiarly the register of the progressive shipowner.

Since writing the above list of new tonnage placed we learn that Messrs. Murdoch & Murray, shipbuilders, Port-Glasgow. have contracted to build two steel screw steamers of 700 tons register. The engines will be compound-surface-condensing, and will be supplied by Messrs. David Rowan & Co., Glasgow, and Messrs. William Walker & Co, shipowners, Greenock, have given an order to Messrs. Russell & Co. to build a steel sailing ship of about 1,400 tons register to Lloyd's highest class.

TRADE NOTES FROM THE TYNE, WEAR, TEES, HARTLEPOOLS, &c.

(From our own Correspondent.)

THE TYNE.

Shipbuilding.—Since last month the improvement in shipbuilding has become more strongly marked, and in the first week of the present month, a good many orders were placed throughout the various centres of the North-east coast. The inevitable rise in the prices of material, which now amounts to 10s. per ton for plates and 7s. 6d. per ton for angles, is beginning to exercise a restraining effect on speculation, and enquiries for vessels of a large class are scarcely so numerous now as they were earlier in the month. Another spurt however is likely to take place very shortly, to be followed by a further rise in the prices of iron and steel, which again may have the effect of checking demand for a period. The aspect of things at the present moment appears to be quite consistent with the opinion on this subject expressed in a former number, namely that the trade revival which is now being experienced at all the leading centres of shipbuilding is likely to be more gradual in growth, and as a consequence more beneficial to the various interests concerned, than former revivals have been. The shipbuilding firms on Tyneside have obtained a good share of the work given out by the Admiralty up to now, the Palmer Shipbuilding and Iron Co. having been commissioned to build three torpedo destroyers, to be named the *Janus*, *Lightning*, and *Porcupine*; and Messrs. Armstrong, Mitchell & Co. having received orders for two such vessels. An order for three vessels of the same class has been given to Messrs. Hawthorn, Leslie & Co, so that there are in all eight of these small but comparatively expensive war vessels to be built on the Tyne. The expectation is pretty general that the order for one of the battleships, which constitute the chief point of interest in this year's naval programme, will be placed in this district, and should this hope be fulfilled, a further stimulus will,

of course, be given to business. The Palmer Co. have booked orders for two 4,000 ton vessels within the past few days, and the chances of a busy year at the Jarrow and Howden yards are thereby further improved. Messrs. Wood & Skinner have put another keel down, making an aggregate of four vessels in progress in their yard, and it is understood that they have other orders in reserve. Messrs. Wigham Richardson & Co.'s yard has at present a very bare appearance, there being on the stocks only one vessel, ordered by the Tyne Steam Shipping Co. for the goods and passenger traffic between Newcastle and London, which is to be called the *New Londoner*. The firm have obtained a few important orders from foreign sources this year, and preparations are being made for commencing work on one or more of these. The firm are carrying out an important repair contract, involving the erection of new cabins and other accessories, on a large steamer belonging to foreign owners, which is now lying at the quay. Messrs. C. S. Swan & Hunter have five large vessels on the stocks and others in preparatory stages. Messrs. R. Stephenson & Co., had not, up to the middle of February, booked any further orders, to supplement the work in hand, which consists of two good-sized steamers and a number of dock gates. These dock gates are practically completed, but the owners of the Barry Docks, by whom they were ordered, are not yet wanting delivery. The Tyne Iron Shipbuilding Co. launched early in the month, the second of the large oil steamers ordered by Messrs. Hunting & Sons, Newcastle. The vessel which is named the *Alnwick*, is a fine specimen of her class and will be fitted up in a similarly elaborate manner, as her sister ship s.s. *Duffield*, launched in December. An attempt to take the *Alnwick* round to Sunderland where her engines had to be fitted, was made on February 9th, but the weather being stormy she broke from the tugboats which were towing her, and had to abandoned. She was however recovered next day after having drifted 40 miles from the coast, and was safely brought back to Shields, having lived through a violent storm as a derelict. When the weather moderated the vessel was safely towed round to the Wear, and is at the time of writing, receiving her machinery at the Palmer's Hill Works. Quite exceptional activity continues to exist at Messrs. Readhead's yard, and at the Edwards Co.'s yard, the state of business is satisfactory. The Smith's Dock Co., North Shields, are kept busy with repair contracts, their pontoon dock being continually in requisition. At other repairing establishments business is good.

Engineering.—The marine engineering trade which necessarily follows the fluctuations of the shipbuilding industry, has, as a matter of course, begun to show very marked improvement, and most of the leading firms in this district have been enabled to take on extra hands during the past few weeks. At the Neptune Works, Low Walker, there is a very important "conversion" contract in hand, a complete set of triple-expansion engines of large power being in course of substitution for the compound engines of a foreign passenger steamer. The North Eastern Engine Works and the Slipway Co.'s Works, at Wallsend, exhibit unmistakable evidences of increasing trade, and the Palmer Co.'s engineering department has, since the opening of the year, become distinctly busier. At the St. Peter's works of Messrs. Hawthorn, Leslie & Co., the splendid Russian passenger steamer, *Petersburg*, is receiving her machinery, and there is a large amount of other work of a special kind being dealt with in the various departments of the establishment. The Tyneside Engineering, Shipbuilding and Repairing Co., Wapping Street, South Shields, have been kept very busy since the opening of their works in the early part of January, among the contracts they have dealt with being a very extensive overhaul of the s.s. *Friede*, belonging to Newcastle owners. Necessary repairs were effected to both hull and engines, and considering the important nature of the work contracted for, it was carried out with very creditable despatch. At Messrs. Abbot's Works, Gateshead, business has improved greatly in almost all departments, but more especially in the iron foundry, where orders for marine engine castings are plentiful. Among the contracts recently booked for this department is one for the cylinders of the two torpedo catchers building by Messrs. Doxford, of Sunderland. Each vessel will have four pairs of cylinders—two pairs for the port and two for the starboard engines—making sixteen cylinders in all for the two vessels. Messrs. Clark, Chapman & Co. are participating to a very full extent in the improved state of business that is being generally manifested, and all their departments are well provided with work. The Newburn Works of Messrs. John Spencer & Sons are now in active operation, the steel-plate rolling department being specially brisk. At the Ouseburn Works, belonging to the firm, a considerable improvement in the state of business has become apparent. Messrs. Carrick & Wardale continue to receive a good many orders for their well-known steam feed, bilge, and ballast pumps, as well as for other specialities. Since the middle of January quite exceptional activity has existed at Messrs. William Reid & Co.'s branch establishment, No. 1, Akenside Hill, Newcastle, the demand, from both home and foreign sources, for the firm's well-known sight feed lubricators and also for reducing valves having been very brisk. Since the advent of the triple-expansion principle in marine engine construction, the popularity of the "Vulcan" lubricator has greatly increased, the reason of this, no doubt, being its absolute reliability in all cases and perfect adaptation to the requirements of high-speed engines. The report issued by the directors of Messrs. George Angus & Co, Limited, for the year ending 31st of December last, was a highly satisfactory one, showing, as it did, a clear profit on the year's working of £33,726 17s. 9d. This, with £11,278 6s. 6d. brought forward from the previous year, left the large available balance of £45,005 4s. 3d., making it possible to pay a dividend of 10 pe cent. for the year on the ordinary shares, besides adding £5,00 to the reserve fund and carrying forward £13,455 4s. 3d. to figure in the next balance sheet. The firm enjoy the uniqu distinction of being able to carry on their business without making bad debts, a circumstance which is most creditable to the directorate and the officials. At the present time trade—especially in the india rubber department of the works—is fairly active, and there is reason to believe that the operations of the firm in the present year will be even more successful than they were last year. Mr. Thos. Beynon, of 9, Dean Street, Newcastle, has been very successful this month in getting orders for most of the specialities for which he is agent. His sales of Engelbert's cylinder oil and other lubricants have been very large, and he has also done exceedingly well with the armoured hose and other specialities of the Irwell Rubber Co. and the White Marine Glue, for paying deck seams, &c., manufactured by Messrs. We M. Walters & Co., Liverpool. Messrs. Crosier and Mills have secured orders for 10 centrifugal pumps of the Capell type, with engines combined, as manufactured by their principals, Messrs.. Thwaites Bros., of Bradford, and exhibited at a recently held industrial exhibition in Newcastle. Three pairs of these are for the torpedo catchers building by the Palmer Co., Jarrow, and two pairs for vessels of a similar type building by Messrs. Wm. Doxford & Sons, Sunderland. The firm have also booked orders for the patent side planers manufactured by Messrs. George Richards & Sons, Manchester, for whom they are the local agents, as well as for several other special machine tools, including a large boring and turning machine (which, when necessary can be adapted for use as a circular lathe), and a combined turret-head boring and turning machine, for Messrs. Thos. Richardson & Sons, Hartlepool. An agency for the sale of the "Allison" gas engine, manufactured by Messrs. G. Allison & Sons, Sunderland, has been established at 15, Dean Street, Newcastle. The engine is compact, simple and reliable, and being also easy to start, and a small consumer of gas, relatively to the power developed, it should command a good sale in this district. Messrs. Noble & Lund, machine tool makers, have done remarkably well since the removal of their business, to the extensive premises acquired by them at Felling, and they have now in hand several orders from shipbuilders and engineers, on the Tyne and elsewhere. The manufacturers of the well-known composition Zynkara for preventing corrosion in steam boilers are experiencing an active demand for their speciality.

Electric Lighting.—Messrs. J. H. Holmes & Co., electric lighting engineers, Newcastle, are extremely busy just now, among the contracts in hand being the lighting of a large oil steamer, at Messrs. Armstrong, Mitchell & Co.'s Low Walker yard. This vessel is to have an installation of 90 lights, and a Suez Canal projector with reversible cage, besides masthead and side lights. A number of self-contained electric hand-lamps, for examining the holds and oil tanks, will also be supplied. The firm are also engaged in lighting the large Russian vessel *Petersburg*, at the works of Messrs. Hawthorn, Leslie & Co. The installation in this case consists of two large coupled plants, capable of supplying 360 lamps. There is also a complete system of electric bells, and an arrangement for ventilating the vessel throughout by six electro-motor fans. Another important contract which the firm have at present in hand, is the thorough overhauling of an Italian passenger-cargo steamer at Messrs. Wigham Richardson & Co.'s yard, Low Walker. Messrs.

Clark, Chapman & Co., are also very busy in the electric lighting department of their establishment.

Blyth.—Ship repairing and dry dock work at this port were, during January, fairly active, but since the advent of the present month business has somewhat fallen off, and at the time of writing is far from brisk. The Blyth Shipbuilding Co. have at present only one small vessel in their docks, and in the shipbuilding yard one of the berths has been vacant for some time. They are, however, putting down a vessel of 3,000 tons carrying capacity in a berth rendered available by the launching of the s s. *Corbridge*—built for Newcastle owners—a couple of weeks ago. There is a large spar-deck steamer on the stocks, which appears to be almost ready for launching. The coal shipments at Blyth in January amounted to 197,537 tons, as against 139,223 tons in the corresponding month last year. The great difference shown, however, must be partly set down to interruptions of work in the last-named period. The coal spouts, which constitute the existing facilities, are kept going almost incessantly, and no further very marked increase in the coal shipments at this port need be looked for, until the additional staiths, which are being erected on the north side of the river, are completed. It is expected that these will be ready for use in the early part of next year, when, if other conditions are favourable, a considerable increase will doubtless be noticeable, not only in the coal shipments, but in the general trade of the port.

THE WEAR.

A good many orders have been secured by Wear shipbuilders within the last few weeks; but for reasons which are doubtless perfectly justifiable, they are disposed to be reticent in the matter of particulars. It is patent to all however, that almost every firm has more or less work to deal with during the present year; but as in many of the yards, the work is yet in a backward state, there is still a scarcity of employment for most classes of operatives. Shipwright labour seems to be the only kind for which there is a fair demand, and there seems to be very few operatives of this class out of work. Messrs. Pickersgill have commenced operations in their yard, and at Messrs. R. Thompson & Sons, where there has also been a temporary cessation of work in the fame-turning department, part material has been delivered for a vessel to be laid down shortly. At Mr. Laing's yard quite exceptional briskness exists, and there is no doubt that this will be a busy year throughout the large establishment. The yards of Messrs. Doxford, Messrs. Short Brothers, and Messrs. Priestman continue brisk, but there does not appear to be any particular pressure at Messrs. Osborne & Graham's yard, where there are only two vessel on the stocks. These however, are of large size and afford employment to a good number of hands. Messrs. McAndrew, Cowan & Potts have two small vessels in progress, and are preparing for the laying down of a third. On the lower reaches of the river, the yard of Messrs. J. L. Thompson & Sons, takes foremost place in the matter of work prospects, as well as in other respects, and all their berths are now occupied. It is reported that the Strand Shipbuilding Co. who since the launch of the s.s. *Mimi*, last October, have had no new work on the stocks, have secured one or two orders, but though there may be truth in the statement, we are at present unable to speak definitely on the point. At the other yards matters remain much the same as reported last month.

Engineering.—The improvement noted last month in the local engineering works is now more strongly marked, and the proportion of unemployed men connected with this industry is comparatively small. At the Palmer's Hill Works the state of business is very satisfactory, and there is reason to believe that the output this year will greatly exceed that of last. The manufacture of Dickinson's patent crank shaft which possesses features quite distinct from its many rivals—continues to form an important item in the business of the establishment. The Southwick Engine Works are busy, and at the North-Eastern Works full activity exists in all departments. Messrs. John Lynn & Co., who some time ago quite doubled their productive capacity have now enough work in hand to keep the whole of their machinery going. The works of Mr. A. A. Rickaby continue to be satisfactorily employed, and at all the foundries there is a substantial increase of orders. Forges, and chain, and anchor works are generally much busier than at the close of last year.

The Hartlepools.—The state of work in the shipbuilding yards has improved considerably in the past two months, and at all the yards there are evidences of present, or coming activity. Since last month the contracts in hand at the Central Marine Engine Works have progressed satisfactorily, and the machinery has been fitted in several new steamers. The s.s. *Ribston* has been steamed at the sheerlegs, and will proceed to sea very shortly. The s.s. *Indralema*, built by Messrs. Swan & Hunter, of Wallsend, for Liverpool owners, was, after being fitted with her machinery, steamed back to the Tyne, where the finishing operations are now being carried out. The s.s. *Rounton* was also steamed at the sheerlegs, and returned to the yard of Messrs. Wm. Gray & Co. The s.s. *Repton* was taken on a trial trip, and proceeded on a voyage to Cardiff. The trial was eminently satisfactory, everything running perfectly, and the vessel travelling at the rate of 10 knots per hour. The s.s. *Twilight* was also sent to sea, and made a satisfactory run to South Wales on her first voyage. Perhaps the most interesting item of the month is the repot received that the s.s. *Maori* which has been fully described in former issues, has arrived at New Zealand, having averaged 11½ knots all the way from Teneriffe, though fully loaded. This is a better result than was looked for, and as may well be supposed, has given unqualified satisfaction to all who were in any way interested. The Hartlepool steel works are very actively employed, and rope works are also busy.

Stockton.—Business in the local shipyards continues fairly good, and the state of affairs at the engineering establishments has undergone a distinct change for the better. The Stockton Forge Co.'s Works are busy, there being orders in hand for stern frames, &c., from shipbuilders on the Tyne and Wear, as well as from firms in the immediate locality. Early in the month a large stern frame was sent from these works to Messrs. Readhead, South Shields, and later on one weighing about 10 tons was despatched to Mr. Laing's yard, Sunderland. The following vessels, engined at the works of Messrs. Blair & Co., have had their trial trips during January:—The s.s. *Mikado*, built by Messrs. Richardson & Duck, of Stockton, for Messrs. Thos. Wilson & Sons, of Hull, having engines with cylinders 23½ in., 39 in., and 64 in. by 42 in. stroke. The s.s. *Hambleton*, built by Messrs. Ropner & Son, of Stockton, for Messrs. J. Merryweather & Son, of West Hartlepool, having engines with cylinders 23in., 37½ in., and 61½ in. by 39 in. stroke. The engines for the first-named vessel are constructed to work at a pressure of 180 lbs., and those of the second-named at a pressure of 160 lbs. On the trial trips the engines of both vessels worked most satisfactorily.

Middlesbro'.—We are pleased to note that the yard of Messrs. Raylton Dixon & Co. is now pretty fully occupied with vessels that are mostly in early stages of progress, and all appearances point to the fact that an exceptionally busy time is at hand. Messrs. Craggs & Sons are also well supplied with orders, and at Messrs. Harkess & Sons' yard a fine cargo steamer of 1,350 tons deadweight carrying capacity on 14 ft. draught of water, has just been completed. The firm have also recently finished a couple of important repair contracts, and have booked an order for a vessel of 1,400 tons deadweight on light draught, for Messrs. Fenwick, Stobart & Co., of London. The firm are now receiving numerous enquiries for steamers of a similar size, and some, it is expected, will lead to business. The many enquiries coming to hand at present tend to show that when business becomes really brisk, this firm will get a full share of whatever work may be going, as they have a reputation for turning out work of a well finished and substantial kind.

Darlington.—The Darlington Forge Co.'s Works are kept steadily going, and there is every prospect that the present satisfactory state of matters will be maintained for some time to come.

THE MERSEY.

(From our own Correspondent.)

THE increased activity which is reported in other shipbuilding centres has so far not extended in any appreciable degree to this district. Both the marine engineering and shipbuilding industries on the Mersey, remain generally in a depressed condition, and on the Liverpool side it would almost seem as if the shipbuilding industry had gone out altogether. Messrs. Royden Bros. have had no important work on hand for nearly twelve months, and their yard remains practically idle except for occasional repair jobs. Messrs. Potter & Sons are scarcely in any much better

position, the only work they have in hand being the building of a couple of small barges. There have been a few enquiries stirring recently, but these have not resulted in new work of any importance being secured, and the outlook shows no present prospect of any material improvement on this exceedingly unsatisfactory state of things. On the Birkenhead side Messrs. Laird Bros. have not been so slack for many years past as they have been recently, all the work they have had in hand for the last month or so having been the finishing of several vessels which were launched towards the close of last year, and these have been principally small Government vessels for torpedo service. They are, however, now in rather a better position, having just received orders from the Government for building three high-speed torpedo-boat catchers of the new class, and although this work will not by any means keep them fully employed, it will at any rate give their yard something to do pretty well over the ensuing year. The only other new work outside Government requirements is an order for building a small private steam-yacht. It is, of course, anticipated that this firm will secure a share of the more important Government work in connection with the building of a large line of battle ships which is expected to be given out, but judging from the excessive keenness with which the Government work has recently been tendered for, it would certainly seem more than doubtful whether even this class of work could, under existing conditions, be secured on anything like remunerative terms. Amongst the marine engineers on the Mersey there is very little work of any moment stirring, and most establishments are only very partially employed. The only matter of special interest to notice is that Messrs. Fawcett, Preston & Co. have just completed one of their patent hydraulic steering gears, of which we gave a full description and illustrations some months ago. This hydraulic gear has been constructed for the steamship *Maroa*, which has been built by Messrs. W. Doxford, of Sunderland, the dimensions of the vessel being :—Length, 455 ft.; breadth, 52 ft.; draught, 26 ft.; with a displacement of 14,500 tons, and to steam at a speed of 11 knots. So far only preliminary trials have been made with this new gearing, but they have, we understand been very satisfactory.

Amongst general engineering work most of the machine tool makers engaged upon special work are getting busier, and Messrs. William Muir & Co., of the Britannia Works, Manchester, have just completed a fairly large order for the Ameer of Afghanistan, consisting of a number of special milling and drilling machines, which have been ordered by Mr. F. S. Pyne, for fitting up an extension of the gun factories at Cabul. To facilitate the difficult overland transit, which has to be performed by camel transport, these tools have had to be constructed in sections, none of which have to weigh more than three cwts., and a short time back Messrs. Muir sent away to Cabul a large boring and rifling machine weighing over 20 tons, which was also made in sections, none of which had to weigh more than three cwt. Messrs. William Muir & Co., have also just completed for a firm of marine engineers on the East coast another of their large vertical milling machines, one of which was described in this journal some time back. This machine is of still more massive proportions and contains several special features. One of these is the introduction of an ingeniously designed compound table (Slade's patent), fixed on the ordinary table by means of which circular objects can be milled round the edges without re-setting the work to the different centres. The advantage of this arrangement was shown by milling all round the edges of a marine crank, at one setting, whilst the machine will also mill straight and general work, as well as couplings, connecting-rod ends, &c., with a patent cutter, about 4 in. diameter, and 12½ in. long, which will take a cut of 12 in. long, by 1 in. deep, at a feed rate of 1 in. per minute. The massive proportions of the machine may be judged of by the fact that it weighs over 28 tons whilst the spindle is 6 in. diameter, the table 5 ft. square, and the distance from the spindle to the body of the machine, 3 ft. 6 in. Amongst other specialities in general machine tools, the Atlas Engineering Co., of Levenshulme, are bringing out a number of new patterns which are mainly improvements on American designs. One of these is a massive machine for boring six 6 in. holes at one time, the tool being fitted with machine-cut steel gearings throughout. They also have in progress a powerful horizontal boring and milling machine for milling a surface 6 ft. by 5ft. at one setting, and so arranged that it will drill and bore holes upon any part of the surface, automatic feeds in all directions with quick traversing motions for moving the upright and carriages from one position to another being a special feature, whilst all the motions are so arranged that they are under the control of the operator, from a platform in front of the carriage. They are also engaged upon a new line of American pattern lathes, and newly-designed milling machines presenting several features of novelty. Amongst these is an American type of lathe with a patented arrangement for cutting a number of pitches without alteration of the change-gears. This is effected by an arrangement of differential gearing, placed inside the bed of the machine, beneath the fixed headstock, the operator simply moving a lever up to a number given upon an index dial, and the required pitch can at once be got. The lathe is specially useful for such articles as have to be fixed in a chuck, and require several pitches to be cut upon them before they are removed. Amongst improved milling machines, embracing all the latest improvements are some of horizontal type which are both plane and universal milling machines, combining the principal features of the latest types of American tools of this class, with the greater strength of English tools. The universal milling machines are provided with an improved central driving arrangement for working the feeds so that the table will traverse at any angle and will swivel completely round. They are also fitted with rotary pumps, parallel vice, chucks, &c., and are designed for doing an exceptionally large range of work. Another tool is a specially ingenious screwing machine, for screwing small bolts, &c., capable of turning out 800 to 1,000 bolts per hour. This machine is also a combination of American ideas with improvements introduced by the firm; the chief feature is that a simple movement of a lever brings the work up to the die and screws it, then releases the dies, and a backward movement of the same lever opens the jaws holding the article, and drops the latter out finished.

With regard to the condition generally throughout the engineering industries of this district there is all through a decidedly more hopeful tone as to the future, although perhaps for the present there is not as yet any actually realised substantial improvement. The returns of the Trades' Union organizations connected with the engineering industries show a slight decrease in the number of unemployed, and one satisfactory feature is that during the last month there has been a marked enquiry for pattern-makers, the local branch of the Amalgamated Society of Engineers having now very few of this class of workmen on the books, and this is taken as a conclusive sign that there must be a fairly large amount of new work in preparation which will shortly find its way into the shops. The Amalgamated Society of Engineers has still about 9½ per cent. of the local membership, and nine per cent. of the total membership of the Society in receipt of out-of-work support, but this is a very considerable improvement upon recent returns, which, however, included a large number of temporary suspensions for the New Year holidays. In the Steam Engine Makers' Society there is about six per cent. of its membership in receipt of out-of-work support, which is still considerably above the average. The annual report of the Steam Engine Makers' Society, which has just been issued, bears evidence of the severe strain upon the resources of this and other similar organisations owing to the exceptionally bad trade of last year, the expenditure having exceeded the income by upwards of £500, which is quite an unusual feature for this organization. The amount paid for out-of-work donation during the year amounted to £7,860, which was an increase over the previous year of £2,545 and of £5,651 over the amount paid to unemployed members in 1891. The most severe part of the depression was felt in marine centres on the Tyne, Wear and Humber, the seven branches on these rivers having paid in donation no less than £1,500. The annual report of the Amalgamated Society of Engineers does not come out until much later in the year, but the returns as to membership which have been made up to the close of 1893 show that this organisation continues to make steady progress; notwithstanding the heavy calls made upon the members during the past twelve months for special levies of one sort or another, something like four thousand new members were admitted, and deducting losses by death and other causes, the increase on the membership for the year amounted to 2,837, the society closing 1893 with a total membership of 73,746.

In the iron trade, business has shown a general and very decided improvement during the past month, with a strong upward movement in all descriptions of raw material. Varied opinions are entertained as to the conditions which have brought about this better state of things. In some quarters it is regarded as due more to the great scarcity of pig-iron brought about by the exceptional conditions of last year than to any greatly in-

creased demand, although this has decidedly improved. In other quarters the view is taken that with iron scarcer now than it has been for many years past, and with the cost of production, both as regards fuel and wages, higher than it has been, with no probability of coming down, there is every likelihood of a still further considerable upward movement in prices. Generally the opinion is that a very firm tone will be maintained, at least, the rates now ruling, and that there is every probability, especially should there be even only a moderately increased demand, that prices will move further upwards. With the close of the month, local makers are very firm at 44s. 6d. to 45s. for forge, to 45s. 6d. for foundry, less 2½ delivered, and are doing fair business. District brands are to a large extent almost out of the market, owing to makers having fully sold their present production over some months ahead, but as several furnaces have been blown in during the last week or so, an increased output will necessarily come upon the market, which will relieve the pressure, although it is scarcely likely to much affect prices. Delivered in the district, Lincolnshire iron is very firm at 43s. for forge, to 44s. for foundry, net cash, and Derbyshire at about 51s. for foundry, less 2½. Outside brands coming into this market are not quoted by makers under 45s. 4d. for good foundry Middlesbrough, net cash, delivered in the Manchester district, whilst Scotch iron is exceedingly scarce, and only small quantities can be bought at about 48s. for Eglinton, and 51s. for Glengarnock, net, prompt cash, delivered at the Lancashire ports.

Finished iron makers have been securing rather more work but not of any very large weight. Prices are, however, hardening up to £5 15s. for Lancashire bars with North Staffordshire very firm at £5 17s. 6d., and makers not at all inclined to sell forward at these figures. Sheets remain at £7 5s. to £7 7s. 6d. for Lancashire, and £7 7s. 6d. to £7 10s. for Staffordshire, whilst Lancashire hoops have been advanced 2s. 6d. and are now quoted at £6 for random, up to £6 5s. for special cut lengths, delivered in this district.

In the steel trade there is a stronger tone generally, except that billets owing to competition from other districts continue very low, and local makers are scarcely able to secure orders even at £4 4s. net cash delivered; but hematites are firm at about 54s. less 2½ for good foundry qualities. In manufactured steel the increased activity in some of the shipbuilding has stiffened up plates, good boiler-making qualities being now quoted at £6 12s. 6d. whilst steel ship-plates range from £5 17s. 6d. for East-coast qualities up to £6 5s. for Clyde plates delivered in this district.

In the metal market, business has been moderate, with no really quotable change for manufactured goods, which are about as under:—Solid drawn brass boiler tubes. 5⅝d.; solid drawn brass surface-condenser tubes, 6¾d.; solid drawn copper tubes, 7¼d.; brazed copper gas and steam tube, 7d.; brass wire 5⅜d.; copper wire, 6⅛d.; rolled brass, 5¼d.; sheet brass, 6½d.; yellow metal bolts, 5½d.; yellow metal condenser plates, 5⅛d.; cast composition sheathing nails and spikes, 5¾d.; cast red metal sheathing nails and spikes, 7⅜d.; wrought copper rivets and washers, 8¼d.; wrought copper boat nails, 8⅛d. to 9¼d.; wrought copper tacks, 11¼d. to 1s. 2¼d.; and cut copper nails, 8d. to 9⅜d. per lb.; copper bolts, £61 per ton.

In the timber trade the position remains much as reported last month. Stocks generally continue ample, though with few exceptions, they can scarcely be called excessive. A slightly better feeling exists, but the indications of any early material improvement in the demand are not of any very substantial character as yet.

The coal trade has been rather quieting down during the month, particularly in the better qualities, and prices have shown a weakening tendency. Inland requirements for steam and forge purposes have been fairly good, but recent maximum rates have scarcely been maintained, and 10s. per ton for steam and forge coals, at the pit mouth, is about the full average figure. For shipment there has been only a very limited demand recently, and decidedly lower prices have been ruling, the competition from other districts having compelled sellers here to give way to secure business. Delivered at the ports on the Mersey, Lancashire steam coal has been readily obtained at 11s. to 11s. 6d. per ton.

A Handbook has been published by the Manchester Ship Canal Company, giving, amongst other information, a schedule of rates and charges, map of Manchester docks, and chronology of chief events concerning the canal.

NORTH-WEST OF ENGLAND.

(From our own Correspondent.)

Barrow.—There is a remarkable state of activity in the shipbuilding trade of Barrow, consequent on the rush of orders which came to hand during the last three months of 1893, both on Admiralty account and on private owners' account, a rush which reached its climax when on the 1st of January the Naval Construction and Armaments Co. booked an order for H.M.S. *Powerful*. The work of preparing the yard for the building of the *Powerful* has been completed, and the blocks are already in line and form for the laying of the keel, a work which will be completed in the course of a few weeks. The yard of the Naval Construction and Armaments Co. is admirably adapted for heavy Admiralty work, as it is as solid and as hard as concrete, and has a very easy incline towards the water. There is room in the Barrow yard for the building of 20 steamers of heavy tonnage abreast, and the area of launching water is considerable and safe. At present there are on the stocks of the Barrow yard 11 steamers in various stages of construction, and a new order recently booked for the construction of a sand pump dredger will soon occupy one of the empty ways. This dredger is for Kingston or Dublin harbour, and is of the same type as the *Brancker* sand dredger built at Barrow for the Mersey Dock Board, and which has made such wonderful progress in the work of dredging away the bar at the entrance to the Liverpool river, but the Dublin dredger will be of smaller dimensions, and it is intended to build the suction tube on one side of the vessel instead of, as in the case of the *Brancker*, the tube working in a central well midships. This change is likely to be a satisfactory one, because a longer tube can be used and the dredger employed at greater depths. During March the British and Irish Steamship Co. will have launched for them at Barrow the s.s. *Lady Wolseley*, a twin-screw Channel steamer, which is expected to be smart in her speed. She will run between Liverpool, Dublin, Portsmouth, and Southampton. The 8,000-ton cargo carrying steamer building at Barrow for Mr. Royden, of Liverpool, is nearly plated, and will be launched in April. The two steamers ordered at Barrow for the British and African Steamship Co. are in frame, and two of the three Clan Liners building at Barrow for Messrs. Cayzer, Irvine & Co. have been laid down and are in course of building. Several large repair orders are in hand at Barrow, and others are coming to hand. There is much briskness in the marine engineering department, and boilermakers and ironfounders have plenty to do. It is probable that the engineering department will soon be on a double shift, as there is not only the engines to build for the steamers which are building, but new engines for several other ships, including those required for H.M.S. *Majestic*, which is being built at Pembroke.

Shipbuilding Material.—There is a much brisker demand for shipbuilding material, and the mills at Barrow, which have been practically idle for two years, are about to be restarted. The experiments which were made a short time ago with a view to the rolling of ingots into plates direct without slabbing have not been successful, but further experiments are about to be tried. In the meantime the Barrow Steel Co. has booked an order for 5,000 tons of plates, for shipbuilding purposes, from Messrs. Neilson Bros., iron and steel merchants, Glasgow, and it is probable that other orders will follow from the same source. There is a good demand in Barrow alone for shipbuilding material, and it is expected that the mills, which have been stopped so long, will now go on briskly for a long time, as arrangements are being completed for the cheapening of production, with the view of enabling local makers to compete successfully in trade.

The Glasgow University Engineering Society held their sixth ordinary meeting on Tuesday night, the 13th February, Mr. Robert Duncan in the chair. The lecturer, Mr. John Weir, read an excellent paper, entitled "Practical Problems in Marine Engineering," treating his subject in a very full and comprehensive manner. He divided his subject under the following heads:—(1) Power and speed of vessels; (2) Comparison of theoretical and actual indicator diagrams; (3) Sizes of engines and boilers; (4) Influence of propellers; (5) Weights of engines and boilers; (6) Water-tube boilers. The last heading was dealt with very fully, and the lecturer exhibited photographs of boilers about to be put into H.M.S. *Powerful*.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Carlisle City.—On Monday, January 19th, there was launched from the yard of Messrs. Wm. Doxford & Sons, Limited, Pallion, a very handsomely-modelled screw steamer, named *Carlisle City*, which has been built by them for Messrs. Furness, Withy & Co., Limited, West Hartlepool. She is 345 ft., by 41½ ft, by 28 ft. 8 in. moulded. Built on the spar-deck rules, with complete shade deck above for the protection of cattle. She had been built to the highest class at Lloyd's, with considerable extra strengthening and is fitted with a cellular bottom throughout. The vessel has been designed and fitted specially for the carriage of live cattle, of which she will carry between 500 and 600 head. She is also fitted throughout in the most handsome manner, including all the most recent improvements, such as electric light, direct steam steering gear, six steam winches and double derricks for the rapid handling of cargo.

Kirkdale.—On January 22nd Messrs. Bartram, Haswell & Co. launched from their yard at Sunderland the steel screw steamer *Kirkdale*, built by Messrs. James R. Cuthbertson & Co., Glasgow. The dimensions are:—Length, 310 ft.; breadth, 41 ft.; and depth, moulded, 28 ft. 4 in. The engines are being constructed by Mr. John Dickinson, and are of about 1,350 I.H.P., the cylinders being 23½ in., 38 in., and 62 in. diameter, by 42 in. stroke.

Madeline.—On Tuesday, February 6th, Messrs. Furness, Withy & Co., Limited, launched from their yard at Hartlepool a large steel screw steamer, built to the order of Messrs. Pyman, Bell & Co., Newcastle-on-Tyne. She is a fine type of a modern cargo boat measuring over 320 ft. in length, and built throughout of Siemens-Martin steel, with a large measurement and deadweight capacity, and built to the highest class at Lloyd's. The vessel has a long raised quarter-deck, long bridge-house, and a topgallant forecastle. The holds are fitted with iron grain divisions, and all decks, deck erections, skylights, bulwarks, bulkheads, &c., are constructed of steel and iron. Cellular bottom fitted all fore and aft for water ballast with Danby's patent cement in bottom. The greater portion of the plates are in 24 ft. lengths, making the structure of the ship very strong. Four steam winches, one donkey boiler, patent steam steering gear amidships, screw gear aft, direct steam patent windlass, stockless anchors, hauling into hawse pipes, and other modern appliances are fitted for the handy working of the vessel. The saloon and cabin providing accommodation for the captain, etc., is handsomely finished in polished hardwood, with painted panels, executed in an effective style by the staff of ladies employed by the firm. The steamer will be rigged as a two-masted fore-and-aft schooner; and has been constructed under the personal supervision of Captain Danby. She will be fitted with triple-expansion engines by Messrs. Blair & Co., Limited, Stockton-on-Tees. On leaving the ways she was gracefully christened *Madeline* by Miss McKinlay.

Alnwick.—On Tuesday, February 6th, there was launched from the yard of the Tyne Iron Shipbuilding Co., Limited, of Willington Quay-on-Tyne, a steel screw steamer built to the order of Messrs. Hunting & Son, of Newcastle-on-Tyne, and of the following dimensions, viz.:—Length, 320 ft.; breadth, 41 ft. 6 in.; depth, 28 ft. 5 in.; moulded and to class 100 A1 at Lloyd's on the spar deck rule. This vessel has water ballast fitted right fore and aft on the cellular system, and is also fitted with all modern improvements for the rapid loading and discharging of cargo including six double-cylindered steam winches, direct-acting steam windlass, by Messrs. Emerson, Walker & Co. Multitubular large donkey boiler, steam steering gear by Messrs. John Hastie & Co., and Hastie's screw gear aft. The engines, which are to be supplied by John Dickinson, of Sunderland, are of the triple-expansion type, having cylinders 24 in., 40 in. and 64 in. by 45 in. stroke, and working at a pressure of 160 lbs. On leaving the ways the vessel was named the *Alnwick* by Miss Mona Hunting, Eachwick Hall, Dalton, Northumberland.

Beeforth.—On February 6th there was launched by Palmer's Shipbuilding & Iron Co., Limited, at Howdon-on-Tyne, a steel screw steamer named the *Beeforth*, built to the order of Messrs. Newton, Appleton & Co., of Hull. The dimensions of the *Beeforth* are as follows:—Length over all, 315 ft.; beam, 43 ft.; and moulded depth, 20 ft. 11 in. She is built to Lloyd's highest class under special survey. The engines are of the triple-expansion type, the cylinders being 24 in., 38 in., and 64 in. diameter respectively, and a piston stroke of 42 in.

Verena.—On February 6th there was launched by Messrs. Wm. White & Sons, at West Cowes, a steel steam yacht, built to the order of Mr. A. Shuttleworth. The vessel has been built to class A1 at Lloyd's, and her principal dimensions are:—Length over all, 173 ft. 6 in.; length, between perpendiculars, 148 ft. 6 in.; breadth, 21 ft.; depth, 13 ft. 5 in.; draught of water, 11 ft.; tonnage, b.m., 320. She will be fitted with a steel boiler and a pair of engines of 77 H.P.

Corbridge.—On Wednesday afternoon, February 7th, the Blyth Shipbuilding Co., Limited, launched, from their Shipbuilding and Graving Dock Works at Blyth, a screw steamer of the partial-awning deck-type, for Newcastle owners. The framework of the vessel is composed of a very strong section of bulb-angle, and web frames are fitted in lieu of hold beams. She has cellular double bottom throughout, and is generally built of exceptional strength and with all modern improvements. The captain and officers will have suitable accommodation under the poop aft, and the engineers' berths, &c., are at the after end of the bridge, and the crew are comfortably provided for under the awning deck forward. The vessel is schooner rigged with telescopic topmasts, has powerful steam winches for rapidly loading and discharging cargo fitted to each hatchway, and has Clarke Chapman's windlass and patent donkey boiler and Hastie's steam steering gear. The ceremony of naming the vessel *Corbridge* was gracefully performed by Mrs. Walter Scott, of Newcastle. The *Corbridge* will proceed to the North-Eastern Marine Engineering Co.'s Works, Wallsend, where powerful triple-expansion engines will be put on board.

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creased demand, although this has decidedly improved. In other quarters the view is taken that with iron scarcer now than it has been for many years past, and with the cost of production, both as regards fuel and wages, higher than it has been, with no probability of coming down, there is every likelihood of a still further considerable upward movement in prices. Generally the opinion is that a very firm tone will be maintained, at least, the rates now ruling, and that there is every probability, especially should there be even only a moderately increased demand, that prices will move further upwards. With the close of the month, local makers are very firm at 44s. 6d. to 45s. for forge, to 45s. 6d. for foundry, less 2½ delivered, and are doing fair business. District brands are to a large extent almost out of the market, owing to makers having fully sold their present production over some months ahead, but as several furnaces have been blown in during the last week or so, an increased output will necessarily come upon the market, which will relieve the pressure, although it is scarcely likely to much affect prices. Delivered in the district, Lincolnshire iron is very firm at 43s. for forge, to 44s. for foundry, net cash, and Derbyshire at about 51s. for foundry, less 2½. Outside brands coming into this market are not quoted by makers under 45s. 4d. for good foundry Middlesbrough, net cash, delivered in the Manchester district, whilst Scotch iron is exceedingly scarce, and only small quantities can be bought at about 48s. for Eglinton, and 51s. for Glengarnock, net, prompt cash, delivered at the Lancashire ports.

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A Handbook has been published by the Manchester Ship Canal Company, giving, amongst other information, a schedule of rates and charges, map of Manchester docks, and chronology of chief events concerning the canal.

NORTH-WEST OF ENGLAND.

(From our own Correspondent.)

Barrow.—There is a remarkable state of activity in the shipbuilding trade of Barrow, consequent on the rush of orders which came to hand during the last three months of 1893, both on Admiralty account and on private owners' account, a rush which reached its climax when on the 1st of January the Naval Construction and Armaments Co. booked an order for H.M.S. *Powerful*. The work of preparing the yard for the building of the *Powerful* has been completed, and the blocks are already in line and form for the laying of the keel, a work which will be completed in the course of a few weeks. The yard of the Naval Construction and Armaments Co. is admirably adapted for heavy Admiralty work, as it is as solid and as hard as concrete, and has a very easy incline towards the water. There is room in the Barrow yard for the building of 20 steamers of heavy tonnage abreast, and the area of launching water is considerable and safe. At present there are on the stocks of the Barrow yard 11 steamers in various stages of construction, and a new order recently booked for the construction of a sand pump dredger will soon occupy one of the empty ways. This dredger is for Kingston or Dublin harbour, and is of the same type as the *Brancker* sand dredger built at Barrow for the Mersey Dock Board, and which has made such wonderful progress in the work of dredging away the bar at the entrance to the Liverpool river, but the Dublin dredger will be of smaller dimensions, and it is intended to build the suction tube on one side of the vessel instead of, as in the case of the *Brancker*, the tube working in a central well midships. This change is likely to be a satisfactory one, because a longer tube can be used and the dredger employed at greater depths. During March the British and Irish Steamship Co. will have launched for them at Barrow the s.s. *Lady Wolseley*, a twin-screw Channel steamer, which is expected to be smart in her speed. She will run between Liverpool, Dublin, Portsmouth, and Southampton. The 8,000-ton cargo carrying steamer building at Barrow for Mr. Royden, of Liverpool, is nearly plated, and will be launched in April. The two steamers ordered at Barrow for the British and African Steamship Co. are in frame, and two of the three Clan Liners building at Barrow for Messrs. Cayzer, Irvine & Co. have been laid down and are in course of building. Several large repair orders are in hand at Barrow, and others are coming to hand. There is much briskness in the marine engineering department, and boilermakers and ironfounders have plenty to do. It is probable that the engineering department will soon be on a double shift, as there is not only the engines to build for the steamers which are building, but new engines for several other ships, including those required for H.M.S. *Majestic*, which is being built at Pembroke.

Shipbuilding Material.—There is a much brisker demand for shipbuilding material, and the mills at Barrow, which have been practically idle for two years, are about to be restarted. The experiments which were made a short time ago with a view to the rolling of ingots into plates direct without slabbing have not been successful, but further experiments are about to be tried. In the meantime the Barrow Steel Co. has booked an order for 5,000 tons of plates, for shipbuilding purposes, from Messrs. Neilson Bros., iron and steel merchants, Glasgow, and it is probable that other orders will follow from the same source. There is a good demand in Barrow alone for shipbuilding material, and it is expected that the mills, which have been stopped so long, will now go on briskly for a long time, as arrangements are being completed for the cheapening of production, with the view of enabling local makers to compete successfully in trade.

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LAUNCHES AND TRIAL TRIPS.

LAUNCHES—ENGLISH.

Carlisle City.—On Monday, January 19th, there was launched from the yard of Messrs. Wm. Doxford & Sons, Limited, Pallion, a very handsomely-modelled screw steamer, named *Carlisle City*, which has been built by them for Messrs. Furness, Withy & Co., Limited, West Hartlepool. She is 345 ft., by 41½ ft., by 28 ft. 8 in. moulded. Built on the spar-deck rules, with complete shade deck above for the protection of cattle. She had been built to the highest class at Lloyd's, with considerable extra strengthening and is fitted with a cellular bottom throughout. The vessel has been designed and fitted specially for the carriage of live cattle, of which she will carry between 500 and 600 head. She is also fitted throughout in the most handsome manner, including all the most recent improvements, such as electric light, direct steam steering gear, six steam winches and double derricks for the rapid handling of cargo.

Kirkdale.—On January 22nd Messrs. Bartram, Haswell & Co. launched from their yard at Sunderland the steel screw steamer *Kirkdale*, built by Messrs. James R. Cuthbertson & Co., Glasgow. The dimensions are:—Length, 310 ft.; breadth, 41 ft.; and depth, moulded, 28 ft. 4 in. The engines are being constructed by Mr. John Dickinson, and are of about 1,350 I.H.P., the cylinders being 23½ in., 38 in., and 62 in. diameter, by 42 in. stroke.

Madeline.—On Tuesday, February 6th, Messrs. Furness, Withy & Co., Limited, launched from their yard at Hartlepool a large steel screw steamer, built to the order of Messrs. Pyman, Bell & Co., Newcastle-on-Tyne. She is a fine type of a modern cargo boat measuring over 320 ft. in length, and built throughout of Siemens-Martin steel, with a large measurement and deadweight capacity, and built to the highest class at Lloyd's. The vessel has a long raised quarter-deck, long bridge-house, and a topgallant forecastle. The holds are fitted with iron grain divisions, and all decks, deck erections, skylights, bulwarks, bulkheads, &c., are constructed of steel and iron. Cellular bottom fitted all fore and aft for water ballast with Danby's patent cement in bottom. The greater portion of the plates are in 24 ft. lengths, making the structure of the ship very strong. Four steam winches, one donkey boiler, patent steam steering gear amidships, screw gear aft, direct steam patent windlass, stockless anchors, hauling into hawse pipes, and other modern appliances are fitted for the handy working of the vessel. The saloon and cabin providing accommodation for the captain, etc., is handsomely finished in polished hardwood, with painted panels, executed in an effective style by the staff of ladies employed by the firm. The steamer will be rigged as a two-masted fore-and-aft schooner; and has been constructed under the personal supervision of Captain Danby. She will be fitted with triple-expansion engines by Messrs. Blair & Co., Limited, Stockton-on-Tees. On leaving the ways she was gracefully christened *Madeline* by Miss McKinlay.

Alnwick.—On Tuesday, February 6th, there was launched from the yard of the Tyne Iron Shipbuilding Co., Limited, of Willington Quay-on-Tyne, a steel screw steamer built to the order of Messrs. Hunting & Son, of Newcastle-on-Tyne, and of the following dimensions, viz.:—Length, 320 ft.; breadth, 41 ft. 6 in.; depth, 28 ft. 5 in.; moulded and to class 100 A1 at Lloyd's on the spar deck rule. This vessel has water ballast fitted right fore and aft on the cellular system, and is also fitted with all modern improvements for the rapid loading and discharging of cargo including six double-cylindered steam winches, direct-acting steam windlass, by Messrs. Emerson, Walker & Co. Multitubular large donkey boiler, steam steering gear by Messrs. John Hastie & Co., and Hastie's screw gear aft. The engines, which are to be supplied by John Dickinson, of Sunderland, are of the triple-expansion type, having cylinders 24 in., 40 in. and 64 in. by 45 in. stroke, and working at a pressure of 160 lbs. On leaving the ways the vessel was named the *Alnwick* by Miss Mona Hunting, Eachwick Hall, Dalton, Northumberland.

Beeforth.—On February 6th there was launched by Palmer's Shipbuilding & Iron Co., Limited, at Howdon-on-Tyne, a steel screw steamer named the *Beeforth*, built to the order of Messrs. Newton, Appleton & Co., of Hull. The dimensions of the *Beeforth* are as follows:—Length over all, 315 ft.; beam, 43 ft.; and moulded depth, 20 ft. 11 in. She is built to Lloyd's highest class under special survey. The engines are of the triple-expansion type, the cylinders being 24 in., 38 in., and 64 in. diameter respectively, and a piston stroke of 42 in.

Verena.—On February 6th there was launched by Messrs. Wm. White & Sons, at West Cowes, a steel steam yacht, built to the order of Mr. A. Shuttleworth. The vessel has been built to class A1 at Lloyd's, and her principal dimensions are:—Length over all, 173 ft. 6 in.; length, between perpendiculars, 148 ft. 6 in.; breadth, 21 ft.; depth, 13 ft. 5 in.; draught of water, 11 ft.; tonnage, b.m., 320. She will be fitted with a steel boiler and a pair of engines of 77 H.P.

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LAUNCHES—English.

Carlisle City.—On Monday, January 19th, there was launched from the yard of Messrs. Wm. Doxford & Sons, Limited, Pallion, a very handsomely-modelled screw steamer, named *Carlisle City*, which has been built by them for Messrs. Furness, Withy & Co., Limited, West Hartlepool. She is 345 ft., by 41½ ft., by 28 ft. 8 in. moulded. Built on the spar-deck rules, with complete shade deck above for the protection of cattle. She had been built to the highest class at Lloyd's, with considerable extra strengthening and is fitted with a cellular bottom throughout. The vessel has been designed and fitted specially for the carriage of live cattle, of which she will carry between 500 and 600 head. She is also fitted throughout in the most handsome manner, including all the most recent improvements, such as electric light, direct steam steering gear, six steam winches and double derricks for the rapid handling of cargo.

Kirkdale.—On January 22nd Messrs. Bartram, Haswell & Co. launched from their yard at Sunderland the steel screw steamer *Kirkdale*, built by Messrs. James R. Cuthbertson & Co., Glasgow. The dimensions are:—Length, 310 ft.; breadth, 41 ft.; and depth, moulded, 28 ft. 4 in. The engines are being constructed by Mr. John Dickinson, and are of about 1,350 I.H.P., the cylinders being 23½ in., 38 in., and 62 in. diameter, by 42 in. stroke.

Madeline.—On Tuesday, February 6th, Messrs. Furness, Withy & Co., Limited, launched from their yard at Hartlepool a large steel screw steamer, built to the order of Messrs. Pyman, Bell & Co., Newcastle-on-Tyne. She is a fine type of a modern cargo boat measuring over 320 ft. in length, and built throughout of Siemens-Martin steel, with a large measurement and deadweight capacity, and built to the highest class at Lloyd's. The vessel has a long raised quarter-deck, long bridge-house, and a topgallant forecastle. The holds are fitted with iron grain divisions, and all decks, deck erections, skylights, bulwarks, bulkheads, &c., are constructed of steel and iron. Cellular bottom fitted all fore and aft for water ballast with Danby's patent cement in bottom. The greater portion of the plates are in 24 ft. lengths, making the structure of the ship very strong. Four steam winches, one donkey boiler, patent steam steering gear amidships, screw gear aft, direct steam patent windlass, stockless anchors, hauling into hawse pipes, and other modern appliances are fitted for the handy working of the vessel. The saloon and cabin providing accommodation for the captain, etc., is handsomely finished in polished hardwood, with painted panels, executed in an effective style by the staff of ladies employed by the firm. The steamer will be rigged as a two-masted fore-and-aft schooner; and has been constructed under the personal supervision of Captain Danby. She will be fitted with triple-expansion engines by Messrs. Blair & Co., Limited, Stockton-on-Tees. On leaving the ways she was gracefully christened *Madeline* by Miss McKinlay.

Alnwick.—On Tuesday, February 6th, there was launched from the yard of the Tyne Iron Shipbuilding Co., Limited, of Willington Quay-on-Tyne, a steel screw steamer built to the order of Messrs. Hunting & Son, of Newcastle-on-Tyne, and of the following dimensions, viz.:—Length, 320 ft.; breadth, 41 ft. 6 in.; depth, 28 ft. 5 in.; moulded and to class 100 A1 at Lloyd's on the spar deck rule. This vessel has water ballast fitted right fore and aft on the cellular system, and is also fitted with all modern improvements for the rapid loading and discharging of cargo including six double-cylindered steam winches, direct-acting steam windlass, by Messrs. Emerson, Walker & Co. Multitubular large donkey boiler, steam steering gear by Messrs. John Hastie & Co., and Hastie's screw gear aft. The engines, which are to be supplied by John Dickinson, of Sunderland, are of the triple-expansion type, having cylinders 24 in., 40 in. and 64 in. by 45 in. stroke, and working at a pressure of 160 lbs. On leaving the ways the vessel was named the *Alnwick* by Miss Mona Hunting, Eachwick Hall, Dalton, Northumberland.

Beeforth.—On February 6th there was launched by Palmer's Shipbuilding & Iron Co., Limited, at Howdon-on-Tyne, a steel screw steamer named the *Beeforth*, built to the order of Messrs. Newton, Appleton & Co., of Hull. The dimensions of the *Beeforth* are as follows:—Length over all, 315 ft.; beam, 43 ft.; and moulded depth, 20 ft. 11 in. She is built to Lloyd's highest class under special survey. The engines are of the triple-expansion type, the cylinders being 24 in., 38 in., and 64 in. diameter respectively, and a piston stroke of 42 in.

Verena.—On February 6th there was launched by Messrs. Wm. White & Sons, at West Cowes, a steel steam yacht, built to the order of Mr. A. Shuttleworth. The vessel has been built to class A1 at Lloyd's, and her principal dimensions are:—Length over all, 173 ft. 6 in.; length, between perpendiculars, 148 ft. 6 in.; breadth, 21 ft.; depth, 13 ft. 5 in.; draught of water, 11 ft.; tonnage, b.m., 320. She will be fitted with a steel boiler and a pair of engines of 77 H.P.

Corbridge.—On Wednesday afternoon, February 7th, the Blyth Shipbuilding Co., Limited, launched, from their Shipbuilding and Graving Dock Works at Blyth, a screw steamer of the partial-awning deck-type, for Newcastle owners. The frame work of the vessel is composed of a very strong section of bulb-angle, and web frames are fitted in lieu of hold beams. She has cellular double bottom throughout, and is generally built of exceptional strength and with all modern improvements. The captain and officers will have suitable accommodation under the poop aft, and the engineers' berths, &c., are at the after end of the bridge, and the crew are comfortably provided for under the awning deck forward. The vessel is schooner rigged with telescopic topmasts, has powerful steam winches for rapidly loading and discharging cargo fitted to each hatchway, and has Clarke Chapman's windlass and patent donkey boiler and Hastie's steam steering gear. The ceremony of naming the vessel *Corbridge* was gracefully performed by Mrs. Walter Scott, of Newcastle. The *Corbridge* will proceed to the North-Eastern Marine Engineering Co.'s Works, Wallsend, where powerful triple-expansion engines will be put on board.

Petersburgh.—On February 7th Messrs. Leslie & Co. launched at Hebburn-on-Tyne a new steamer named the *Petersburgh*, built for the Russian Volunteer Fleet Co. The *Petersburgh* is a three-masted twin-screw vessel, 460 ft. in length over all, 54 ft. beam, and 35 ft. deep. Her capacity exceeds 6,000 tons measurement. Her speed is to be 19 knots, and bunker capacity 1,200 tons, while her 'tween decks contain berths for 1,500 emigrants or troops as occasion may require. The propelling and auxiliary engines number altogether 40. The former are in two sets working triple-expansion, having cylinders 34 in., 54 in., and 85 in. by 51 in. stroke.

Norman.—On February 8th Messrs. Cook, Welton & Gemmell launched at Hull a steam trawler, built to the order of Messrs. Thomas Robinson, of Grimsby. The vessel was named *Norman*.

Kalmia.—On February 8th, Messrs. Cochrane & Cooper, of Grovehill, Beverley, launched a steam line fishing vessel, for the North-Eastern Steam Fishing Co., of Grimsby. The steamer, which was named the *Kalmia*, is 105 ft. between perpendiculars, 21 ft. beam, and 11 ft. 6 in. depth of hold. She is built to Lloyd's highest class. Her engines, of 50 H.P. triple-expansion, will be supplied by Messrs. C. D. Holmes & Co., of Hull.

Ladye Mairy.—On February 8th there was launched from the yard of Messrs. Day, Summers & Co., Southampton, the steam yacht *Ladye Mairy*, her dimensions are:—Length over all, 150 ft.; length between perpendiculars, 128 ft. 9 in.; breadth, extreme, 19 ft. 2½ in.; depth at centre from top of keel to deck, 12 ft. 6 in.; tonnage B.M., 230. The yacht has been built of steel to Lloyd's highest class from designs by the firm. She has two pole-masts, and is rigged as a fore-and-aft schooner with cutwater stem, handsome carved shield figure-head, and trail board of floral design, and has a square stern with gilt carved quarter badge and rope moulding. The steering gear is Archer's patent, and is fitted on bridge deck forward, and there is in addition a screw steering gear aft. The yacht carries three boats and a steam-launch, and is fitted with Reid's patent steam windlass to work either by hand or steam; the anchors are Thomas & Nicholson's patent. The owner's accommodation is all abaft the engine-room, and consists of large deckhouse and saloon, five state cabins, ladies' cabin, linen room and usual offices below deck. The saloon has a panelled walnut dado, the bulkheads and sides above being covered with handsome tapestry supplied by Messrs. Shoolbred, of London, who are upholstering the yacht and carrying out the decorations of the saloon for the owner. The doors, furniture and fittings of saloon, state cabins and sides of passage between same are of polished walnut and the fittings electro-plated. The vessel has two deckhouses of teak, the forward containing officers' mess-

room and companion entrance with galley at after end, the house being extended back over boiler-room with entrance to stokehold and fitted with drying rooms at side. The top of this house forms bridge and flying-bridge, from which the vessel is steered. The after-deckhouse situated abaft main mast contains the dining saloon, pantry and companion entrance to cabin below; the roofing of this deckhouse forms promenade and has brass stanchions and teak handrail round same. The officers' accommodation is forward of the machinery space and the crew are berthed in hammocks in the forecastle. The engines are of the compound surface condensing type, with cylinders 15½ in. and 30 in. diameter and 23 in. stroke, steam being supplied by a multitubular steel boiler working at a pressure of 100 lbs. per square inch. She has a cross bunker between engine and boiler rooms, and side bunkers of a total capacity of 40 tons.

Chatburn.—On February 8th, Messrs. Wm. Gray & Co. Limited, launched a fine steel screw steamer of the following dimensions, viz.:—Length over all, 280 ft.; breadth, 37 ft.; depth, 20 ft. She has been built to the order of Messrs. Murrell & Yeoman, of West Hartlepool, and will take Lloyd's highest class. The deck erections consist of poop, raised quarter-deck, long bridge and topgallant forecastle. A handsome saloon, state room and accommodation for captain and officers will be fitted up in the poop, and comfortable quarters for the engineers at the after end of the bridge, and for the crew in the fore end of the bridge. The hull is built with web frames, a double bottom is fitted under each hold for water-ballast, and there is also a large ballast tank in the after peak. Four steam winches, donkey boiler, steam steering gear amidships, screw steering gear aft, patent windlass by Emerson, Walker & Co., Limited, schooner rig, boats on beams overhead, and all modern appliances will be fitted. The engines are of the triple-expansion type working on three cranks. They are supplied by the Central Marine Engine Works of Messrs. Wm. Gray & Co., Limited. The cylinders are 20 in., 31½ in., and 53 in. diameter, and the piston stroke 36 in. The boilers, built of steel, are of large size and will give an ample supply of steam at a working pressure of 160 lbs. per square inch. The ceremony of naming the ship *Chatburn* was gracefully performed by Miss Yeoman, daughter of one of the managing owners.

Peter Jebsen.—There has been lately launched from the shipbuilding yard of Messrs. J. Readhead & Sons, South Shields, a screw steamer built to the order of Messrs. Bergh & Bell, of Bergen. The vessel is constructed of steel, and is of the partial awning-deck type, with poop and raised quarter-deck aft. She will have the highest class at Lloyd's under special survey, and Norwegian Veritas. Her deadweight carrying capacity will be 4,850 tons. She will be fitted with engines of the following measurements:—24 in., 40 in. and 64 in. by 42 in. stroke, and the steam will be supplied by two large steel boilers working a pressure of 160 lbs.

Dimitri.—On February 8th there was launched by Messrs. Anderson, Laverick & Co., at St. Lawrence-on-Tyne, a steel screw tug named the *Dimitri*, which has been built to the order of Mr. P. S. Logothettis, of Taganrog. The vessel will be fitted with compound surface-condensing engines by Messrs. Ross & Duncan, having cylinders 11 in. and 22 in. by 16 in. stroke.

Osborne.—On Monday afternoon, February 19th, there was launched from the shipbuilding yard of Messrs. C. S. Swan & Hunter, of Wallsend, a steel screw steamer of the following dimensions:—Length, over all, 346 ft.; breadth, 42 ft. 6 in.; depth, 29 ft. 3 in.; built on the spar-deck grade, classed 100 A1 at Lloyd's, and B.S.* in the "British Corporation" Register. The vessel has a long bridge-house amidships, and topgallant forecastle, water-ballast in a cellular double bottom all fore and aft. She will be fitted with triple-expansion engines by Messrs. George Clark, Limited, Southwick Engine Works, Sunderland, cylinders 26 in., 42 in., 69 in., by 48 in. stroke, two large steel boilers 160 lbs. pressure, and forced draught on Messrs. James Howden & Co.'s system, and will attain a high rate of speed The vessel has been built to the order of Messrs. Raeburn & Verel, of Glasgow, and is to be employed in their Calcutta to London trade, under the flag of the India Mutual Line. On leaving the ways she was named the *Osborne* by Mrs. W. H. Raeburn, of Glasgow.

Brinkburn.—On Tuesday afternoon, February 20th, Messrs. Richardson, Duck & Co. launched from their yard a steel screw steamer of the following dimensions:—Length, over all, 342 ft.; beam, extreme, 43 ft.; depth, moulded, 28 ft. 9 in.; gross tonnage about 3,250 tons. This vessel has been built to the order of Messrs. Harris & Dixon, of London, will take Lloyd's highest class, and has been built under special survey. She is of the spar-deck type, having a deck-house aft for captain; bridge over engines and boilers, in after end of which engineers and officers are berthed, and a topgallant forecastle for crew. The vessel will be rigged as a schooner, has a double bottom fore and aft on the Macintyre principle for water-ballast, and her equipment includes five steam winches, large donkey boiler, steam windlass, steam steering gear, stockless anchors, double derricks, light towers on forecastle, and every modern appliance for speedy loading and discharging. Triple-expansion engines of 1,100 I.H.P. will be fitted on board by Messrs. Blair & Co., of Stockton. She has been superintended during construction by Mr. H. M. Rogers, the owner's superintendent. Captain Watson will overlook the fitting out, and take command on completion. As the vessel was leaving the ways she was christened *Brinkburn* by Miss J. J. Croker, of Cheltenham. This vessel is a sister ship to the s.s. *Courtfield*, launched by the builders for the same owners some months ago.

Kurrachee.—On February 20th there was launched by Edwards' Shipbuilding Co., Limited, at Howdon-on-Tyne, the first of two large steamers which have been built to the order of Mr. R. S. Donkin, M.P. for Tynemouth. The vessel, which was named *Kurrachee*, is built of steel, and is of the following dimensions, namely:—350 ft. between perpendiculars; breadth, 43 ft.; depth (moulded), 29 ft. 3 in. She has been constructed under Lloyd's special survey, for their highest class under the three-deck rules. The engines, which are being built by Messrs. Blair & Co., Limited, of Stockton, are of the triple-expansion type, having cylinders of 24 in., 40 in. and 66 in., with a piston stroke of 45 in.

George Pyman.—On February 21st Messrs. Irvine & Co. launched a fine steel-screw steamer of about 3,100 tons deadweight carrying capacity, built to the order of Messrs. Geo. Pyman & Co., of West Hartlepool. The vessel will take Lloyd's highest class, and has been built under special survey. Her dimensions are 291 ft. by 38 ft. 6 in. by 20 ft. 3 in. The deck erections consist of half poop, raised quarter-deck, and long bridge extending beyond foremast, and topgallant forecastle. The saloon and cabins for captain and officers are fitted up in poop aft. The engineers are berthed at after end of bridge and crew at fore end. The hull is built on the web frame principle, with double bottom for water ballast. Large hatchways are fitted, four steam winches, steam steering gear amidships, screw gear aft, large donkey boiler, and direct steam windlass. The boats are placed on beams overhead, and all modern appliances will be fitted for general trading. Engines of the triple-expansion type, are being supplied by Messrs. T. Richardson & Sons, Hartlepool. The hull and machinery have been built under the supervision of the owners' superintendents, Captain Pyman and Mr. Cromer. The christening ceremony was gracefully performed by Miss Winnie Pyman, daughter of Councillor Geo. Pyman, J.P., who named the vessel *George Pyman.*

Bearn.—On February 22nd there was launched from the Cleveland dockyard of Sir Raylton Dixon & Co., Middlesbrough, a steel screw steamer, which has been built to the order of Messrs. Delmas Bros., of La Rochelle. The vessel is of the flush deck type, with poop, bridge, and topgallant forecastle, and has been built under special survey for Lloyd's 100 A1 class. The principal dimensions are:—Length, 241 ft.; beam, 34 ft. 6 in.; depth, moulded, 19 ft.; and she will have a deadweight carrying capacity of about 2,000 tons on a light draught of water. Water ballast is provided for in cellular double bottom and also in the after peak tank. The most recent improvements have been adopted in the machinery for loading and discharging of cargo, and for working the anchor, &c. Handsome accommodation will be fitted up in the bridge-house for the captain, officers, engineers, and a few passengers. The engines will be fitted by the North-Eastern Marine Engineering Co., Limited, of Wallsend-on-Tyne, the cylinders being 17½ in., 28 in., and 46 in. by 33 in., with one single-ended boiler of extra large size, working at 160 lbs. pressure. The steamer was named the *Bearn* by Mrs. Irwin, of Liverpool, wife of Mr. T. F. Irwin, who has superintended the construction of the vessel and her machinery.

Strathness.—On Thursday, February 22nd, Messrs. William Gray & Co., Limited, launched the steel screw steamer

Strathness, which has been built to the order of Messrs. Burrell & Son, of Glasgow. She will take Lloyd's highest class, and her dimensions are:—Length over all, 376 ft. 6 in.; breadth, 47 ft.; depth, 29 ft. 9 in. The deck erections consist of poop, bridge and topgallant forecastle. Two complete iron decks are laid, and a cellular double bottom is fitted throughout the ship for water ballast. The saloon, captain and officers' accommodation, &c., will be fitted up aft, the engineers' accommodation amidships, and the crew's berths forward. The arrangements for working the ship and handling cargo will be of the most efficient description, including patent direct steam capstan windlass, by Emerson, Walker & Co., steam steering gear, seven steam winches, large multitubular donkey boiler, &c. Triple-expansion engines are being supplied by the Central Marine Engine Works of Messrs. Wm. Gray & Co, Limited. The cylinders are 27 in., 43 in. and 72 in. diameter, with a piston stroke of 45 in., and two large boilers of the single-ended type, designed for a working pressure of 170 lbs. per square inch, to work by Howden's patent system of forced draught. There were present at the launch, Sir Wm. and Lady Gray, Mr. Wm. Burrell, one of the managing owners; Mr. G. H. Baines, Mr. T. Mudd, Mr. and Mrs. G. Jones, Miss Baines, Miss Sherwood, &c., and the ceremony of christening the steamer *Strathness* was performed by Lady Gray.

LAUNCHES—Scotch.

Athlete.—On January 23rd there was launched by the Abercorn Shipbuilding Co. the steel screw tug *Athlete*, of 105 gross tons, for foreign owners. She will be fitted with triple-expansion engines of about 300 I H.P.

Opal.—On January 24th there was launched from the shipbuilding yard of Messrs. Scott & Sons, Bowling, a screw steamer of 700 tons, built to the order of Mr. William Robertson, 15, Gordon Street, Glasgow. Triple-expansion engines are being supplied by Messrs. Muir & Houston, Glasgow. On moving down the ways the steamer was named *Opal* by Miss Margaret Robin, Castlehill, Hamilton.

Riversdale.—On January 24th Messrs. Wm. Hamilton & Co., shipbuilders, Port Glasgow, launched at high water a three-masted steel sailing ship of 2,200 tons register, to carry 3,800 tons cargo. This vessel has been built to the order of Messrs. R. W. Leyland & Co., Liverpool, and on leaving the ways was gracefully named *Riversdale* by Miss Haddock, sister of one of the partners of the firm.

Blanche Rock.—On January 25th the Ailsa Shipbuilding Co. launched from their shipbuilding yard at Troon, a steel screw-steamer—length, 169 ft.; breadth moulded, 25 ft. 6 in.; depth moulded, 12 ft. 7in. Built to the order of Messrs. Alfred Rowland & Co., of Liverpool, for the coasting trade. She will be fitted with compound engines, 21 in. and 42 in. cylinders, by 30 in. stroke, by Messrs. Muir & Houston, Glasgow. This is the second steamer built at Troon for same owners. The vessel was named the *Blanche Rock* by Mrs. Carswell, Troon.

Augusta.—On January 25th there was launched from the Montrose Shipbuilding and Engineering Co.'s yard a screw steel tug, built to the order of Mr. Joseph Constant, London. The vessel is the same size as the one launched on Saturday, Jan. 20. Mrs. Phin, wife of Mr. Alex. Phin, chemist, performed the ceremony of christening the boat, which is named *Augusta*. The yard is the scene of great activity at present.

Princess Victoria.—On January 25th, an addition was made to the fleet of the Glasgow and Liverpool Royal Steam Packet Co. by the launch of the *Princess Victoria*, a screw-steamer, from the yard of Messrs. W. B. Thompson & Co., Limited, of Dundee. The vessel is 1,230 tons gross register: is 255 ft. in length, 35 ft. in breadth, and 15 ft. in depth. She has been built to the highest class at Lloyd's, and is intended for the company's Dundee, Liverpool, and Manchester trade. The engines are of the triple-expansion type, having cylinders of 22, 35, and 57 in. diameter respectively, with a piston stroke of 30 in. There are two single-ended boilers, having a working pressure of 160 lb. per square inch. The machinery and boilers have been constructed at the engine and boiler works of Messrs. Thompson. Steam steering gear has been provided by Messrs. Caldwell & Co., Glasgow. Accommodation is provided for about 106 first-class passengers. Including the ladies' cabin there are 24 first-class state-rooms, all handsomely furnished, and at the aft end of the vessel berths can be arranged for 14 passengers. Altogether there is sleeping accommodation for about 130 persons. The captain's and chief officer's rooms are on the fore part of the poop deck, and the chart-room is immediately above on the bridge deck. The officers' rooms are at the aft end of the forecastle. Amidships there is a large gentlemen's lavatory and two bath-houses, and a mess-room for officers. The vessel will be fitted with the electric light by Messrs. Martin & Co., Glasgow. The steamer has been built under the supervision of Mr. Bowie, the company's superintendent engineer.

Glenclune.—On January 26th Messrs. A. Rodger & Co., shipbuilders, Port Glasgow, launched from their yard a handsome three-masted steel sailing barque built to the order of the Glenclune Shipping Co., Glasgow. The principal dimensions of the vessel are:—Length, 240 ft.; breadth, 37 ft.; depth, 21 ft. 8 in.; registered tonnage, 1,370, with a carrying capacity of 2,550 tons. Mrs. Anderson Rodger, of Glenpark, gracefully performed the ceremony of christening the vessel the *Glenclune*.

Clan Galbraith.—On February 1st Messrs. Russell & Co. launched from Kingston Yard, Port Glasgow, a four-masted steel barque of 2,000 tons register, to carry 3,450 tons cargo. Dimensions:—Length, 283 ft.; breadth, 40 ft.; depth, 24½ ft. The owners are Messrs. Thomas Dunlop & Sons, Glasgow. This vessel is a duplicate of the *Clan Graham*, launched a few months ago by Messrs. Russell & Co. for the same owners. She will fit out in the James Watt Dock, Greenock. The ceremony of naming the vessel *Clan Galbraith* was gracefully performed by Mrs. Walter Galbraith, 7, Holyrood Crescent, Glasgow. The vessel will load at Messrs. Aitken & Lilburn's Dock, Glasgow, for Sydney, N.S.W.

Vina.—On February 3rd there was launched from the yard of Messrs. Ramage & Ferguson, Leith, the second of two screw-steamers, of about 1,000 tons, built to the order of Mr. J. T. Salvesen & Co., Grangemouth. The dimensions are 216 ft. by 32 ft. by 16 ft. 3 in., with triple-expansion engines, having cylinders 15 in., 24 in., 39 in., by 30 in. stroke, and one large boiler working at 160 lb. pressure. This vessel, which will carry 1,300 tons deadweight, and is expected to steam 10 knots, is a sister ship to the *Vala*, built by Messrs. Ramage & Ferguson Limited, for the same owners in December last. On leaving the ways the vessel was named *Vina* by Mrs. Theodore Salvesen of Inverleith Terrace, Edinburgh.

The Don.—On February 7th the Montrose Shipbuilding and Engineering Co., Limited, launched the *Don*, this being the last of the three steel screw tugs which this company have built for Mr. Joseph Constant, London. This vessel is the same size and exactly the same in every respect as the first two, and will also be engined by Messrs. Gourlay Brothers, Dundee.

Ben Dearg.—On February 19th Messrs. Charles Connell & Co. launched from their Scotstoun Shipbuilding Yard, Whiteinch, a splendid full-rigged three-masted steel sailing ship, built to the order of Messrs. Watson Bros., of Glasgow, for their well-known Ben line of sailing vessels. She measures about 2,150 tons, has been constructed to the British Corporation and Lloyd's highest class under the personal supervision of Captain Shaw, being an exceptionally well-equipped vessel, and is fitted with all the most recent appliances for the rapid and efficient working of ship and cargo. She has a full East India outfit, and is supplied with the most approved labour-saving appliances for expeditious handling aloft, among which are Shaw & Hastie's patent halyard winches, of special design, at each mast for hoisting and lowering the topsail and topgallant sail yards, each yard having an independent winch of its own. On leaving the ways the vessel was gracefully named the *Ben Dearg* by Miss Steel, daughter of Mr. Robert H. Steel, of the Glasgow and Greenock Shipping Co. The *Ben Dearg* is to be commanded by Captain Beattie.

Duke of York.—On February 20th there was safely launched from the yard of Messrs. Wm. Denny & Bros., Dumbarton, the steel twin-screw steamship *Duke of York*, on which the christening ceremony was performed a week ago by Miss Turnstall, daughter of Mr. Wm. Turnstall, Reedyford House, Nelson, Lancashire, but owing to the stormy weather which prevailed then the launch itself had to be postponed. The *Duke of York* has been built to the order of the Lancashire and Yorkshire and London and North-Western Joint Railway Co.'s for their Fleetwood and Belfast service, and is of the following dimensions:

310 ft. by 37 ft. by 17 ft., and of about 1,600 tons gross register. She will be fitted with her machinery by Messrs. Denny & Co. Amongst those present to witness the launch were Mr. J. G. Armyttage, chairman of the Lancashire and Yorkshire Railway; Mr. Wm. Turnstall, vice-chairman; Miss Tunstall and Mrs. Dewhurst, Mr. J. Naylor, director; Mr. J. H. Stafford, general manager, and Mrs. Stafford; Mr. J. Aspinall, chief mechanical engineer, and Mrs. Aspinall; Mr. C. Moorhouse, solicitor, and daughter; Mr. J. Hunt, engineer, and Mrs. Hunt; Mr. C. W. Bayley, secretary, and Mrs. Bayley; Capt. Jackson, marine superintendent; Mr. A. T. Gibson, superintending engineer; Capt. J. Cooke, commander of the *Duke of Clarence;* Mr. Sibbald, of Messrs. A. A. Laird & Co.; Dr. Dougan, Glasgow; Mr. Hayes, Mr. Smith, &c.

Majestic.—On February 20th Messrs. Lobnitz & Co. launched a twin-screw hopper dredger for Messrs. S. Pearson & Son, London. This dredger is 206 ft. long, 40 ft. beam, and 17 ft. 3 in deep, and will carry 800 tons in her hoppers. She is fitted with two sets of triple-expansion engines for propelling the vessel, and compound engines for dredging. The dredging machinery is very powerful, and specially designed for dredging rock. The vessel will dredge to a depth of 45 ft. below water, and will cut her own flotation. For very hard rock she is arranged for Lobnitz's patent rock-cutting apparatus, and also as a pump dredger to discharge direct ashore through floating pipes. The vessel is fitted with a steam launch, steam steering gear, and electric light throughout. The machinery, as well as the hull, have been constructed by Messrs. Lobnitz & Co. On leaving the ways the steamer was named *Majestic* by Miss Pearson, of London. This is the sixth dredger built for the same owners by Messrs. Lobnitz & Co.

Two Barges.—On February 20th the Montrose Shipbuilding and Engineering Co. launched from their yard two of the six barges built to the order of Mr. Joseph Constant, London. Their dimensions are:—Length, 79 ft.; beam, 21 ft. 9 in.; and depth of hold, 8 ft. They are built of steel, in a style similar to London barges. They are fitted with an ordinary barge windlass, and with a cabin aft for the accommodation of the bargemen.

Vittoria.—On February 21st there was launched from the yard of the London and Glasgow Engineering and Iron Shipbuilding Co., Limited, Govan, a steel screw steamer for Messrs. Allan C. Gow & Co., of Glasgow. The dimensions of the vessel are as follows:—Length, 300 ft.; breadth, 42 ft.; and depth moulded, 22 ft.; of about 4,100 tons deadweight capacity. She has been designed to embrace the latest improvements in cargo steamers, with special regard to the grain carrying trade, in which the new steamer will be largely engaged, and is in all respects constructed to Lloyd's rules for the highest class. The engines, also supplied by the builders, are triple-compound, having three cylinders 23 in. by 37 in., and 61 in. diameter by 42 in. stroke, and the boilers, two in number, single ended, each with three furnaces, 160 lbs. working pressure. The winches are by Messrs. Clarke, Chapman & Co. The windlass also by Messrs. Clarke, Chapman & Co., and the steam steering gear by Messrs. Muir & Caldwell The ship and engines have been built under the special direction of Mr. George McFarlane. As the vessel entered the water, she was gracefully named the *Vittoria* by Mrs. Leonard Gow, Jun.

LAUNCHES—Irish.

Sultan.—On January 26th Messrs. Workman, Clark & Co., Limited, launched at Belfast a steel screw steamer, named the *Sultan*. Her principal dimensions are:—Length, 258 ft. 6 in.; breadth, 38 ft.; depth, moulded, 24 ft. 3 in. She has been built to Lloyd's 100 A1 spar-deck class, under special survey, and the machinery consists of triple-expansion engines.

Pontic.—On Saturday morning February 3rd, at half-past nine o'clock, Messrs. Harland & Wolff launched from the Queen's Island a steel screw steamer of 150 ft. in length, named the *Pontic*. The new steamer is for the White Star Co., and
·tended to carry cargo, luggage, &c., from the dock or landing
; in Liverpool to the large Atlantic liners of the company
· lying in the river Mersey. For her special employment
hip [illegible] large hatches and powerful winches and
cks, [illegible] ay be unloaded with the utmost rapidity.
mn [illegible] icers and engineers will be provided in
afte [illegible] essel, and for the crew forward. The
Pontic will be fitted with triple-expansion engines of the most recent type, constructed in the workshops of the builders of the vessel.

LAUNCHES—American.

North-West.—On January 6th the s.s. *North-West* was launched from the yard of the Globe Iron Works, Cleveland, of the Great Northern R.R., the largest passenger steamer on the great lakes of America. Its principal features are:—Length, over all, 383 ft.; keel, 360 ft.; beam, 44 ft.; depth, 26 ft.; engines, quadruple-expansion, of 7,500 I H.P.; boilers, 28, of the Bellville type. The vessel is designed to develop a speed of over 20 miles per hour.

Jamestown.—On January 3rd there was launched from the yard of John Roach, Chester, Pa., the s.s. *Jamestown*, for the Old Dominion S.S. Co. The vessel has a length of 300 ft. keel, 342 ft. over all, 40 ft. beam, and 26 ft. 9 in. depth of hold. She will be schooner-rigged with two masts. The engines will be of the triple-expansion type, with cylinders 28 in., 44½ in., and 73 in. diameter, with 54 in. stroke. The propeller is of manganese bronze, and the vessel is expected to develop a speed of fifteen knots per hour. The boat has accommodation for 100 first-class passengers.

TRIAL TRIPS.

Horsa.—On January 10th the fine new screw-steamer *Horsa* left the Hartlepools for a trial of her machinery, before proceeding to the Tyne to load her first cargo. This steamer has been built by Sir William Gray & Co. to the highest class at Lloyd's, and engined by Messrs. T. Richardson & Sons, and is of the following dimensions:—Length, 324 ft.; beam, 40 ft. 6 in.; depth of hold, 23 ft. 8½ in. The engines are of the makers' well-known triple-expansion type, fitted out in the most complete manner with several important accessories for efficiency and economy in working. The diameter of the cylinders are 23 in., 38 in., and 62 in., with a stroke of 42 in. Each of the cylinders is fitted with a double-ported slide valve, the receivers being efficiently drained by Geddes's pulsator economisers. The auxiliary feed-water is supplied by a Morison's evaporator, conveniently arranged in the engine-room, so that it is readily accessible for cleaning purposes. The boilers are single-ended, of large capacity, and arranged for a working pressure of 160lbs. per square inch. Furnaces of the well-known suspension type have been fitted, and these are arranged with Geddes's protector fire doors, which are admirably adapted for efficient stoking. The whole of the machinery has been constructed under the personal superintendence of Mr. J. R. Fothergill, of West Hartlepool. At this season of the year the weather is usually of an unpropitious nature for trial trips. The working of the machinery, however, was most satisfactory, and during an extended run in Hartlepool Bay, there was an abundant supply of steam, a speed of 10½ knots being obtained.

Queen Olga.—On January 31st, the new Russian passenger steamer *Queen Olga*, built by Messrs. William Denny & Brothers, and engined by Messrs. Denny & Co., Dumbarton, proceeded on her speed trials between the Cloch and Cumbrae Lights. The owners are the Russian Steam Navigation and Trading Co. of Odessa, and the steamer is intended for the service between Odessa and Alexandria. The vessel is 360 ft. long on load water line, and 45 ft. beam, and 30 ft. 1 in. moulded depth. The over-all length of the vessel is about 390 ft.; there being a smart clipper bow, the figure-head being a representation of the Queen of Greece, wearing her crown, and prepared from a special photograph. The gross tonnage of the vessel is about 4,700, and she has accommodation for 61 first-class, 37 second, and 300 third-class passengers. The first-class passengers are accommodated in the bridge, the dining saloon being forward on the upper deck and occupying the full breadth of the ship. The music saloon, a beautifully decorated apartment, is on the promenade deck, while adjoining are the ladies' saloon and the smoking-room. The second-class passengers are housed in the poop. The feature of the ship is her machinery, as in it is embodied a new arrangement invented by Mr. Walter Brock, of Messrs. Denny's firm, and Mr. James Weir, of the Cathcart firm. The object of

this invention is to enable the engines to be worked at low power with the same economy as at full power. Under full power the engines work on the ordinary triple-compound principle. Above the high-pressure cylinder there is another cylinder of less diameter, and when low power is desired this auxiliary cylinder is brought into requisition by a simple arrangement of valves, and the machinery then works upon the quadruple principle, the steam pressure being in all cases 175 lb. to the square inch. There are four single-ended boilers with 12 unusually large furnaces. The vessel proceeded on a six hours trial, during which she ran the lights six times, the mean speed being 14½ knots, while the I.H.P. was 3,500. The weather was favourable for a successful trial, and a large company was present. Colonel John W. Denny, who presided at the dinner, in proposing success to the *Queen Olga*, remarked that this was the second vessel built by them for the Russian Steam Navigation and Trading Co., the first being the *Tchickikoff*.

Duffield.—On Thursday, February 1st, the magnificent oil tank steamer *Duffield*, built for carrying oil in bulk by the Tyne Iron Shipbuilding Co., Limited, of Willington Quay-on-Tyne, proceeded to sea on her trial trip. The vessel, which is of exceptionally large size, is over 350 ft. long by 44 ft. broad, by 30 ft. 2 in. deep, and carries upwards of 5,000 tons deadweight all told. She is of the spar-decked type with long poop covering the machinery, short bridge and topgallant forecastle, while a broad gangway joins these sections and forms a safe and comfortable means of communication from one end of the ship to the other. She is a notable addition to the now extensive fleet of tank oil steamers, and is fitted with every modern improvement, including in her outfit the most recent inventions, double steam warping capstans both forward and aft, direct-acting steam windlass, steam winches, tramways for running coal along the whole length of the vessel, thus materially easing the labours of the stokers. She is also fitted with what is probably one of the latest labour-saving ideas, and that is an ash ejector by Mechan & Son, of Glasgow. This appliance saves an enormous amount of work in the stokehold besides all the worry and annoyance attendant upon the hoisting of ashes up through the stokehold ventilator, as is the ordinary practice. Her steering arrangements are of the most perfect description, and consist of a set of Hastie's combined screw and steam, and hand steering gear fitted in conjunction with Wilson & Pirrie's patent spring quadrant, and the whole is fitted up aft and controlled from the bridge by means of shafting led aft from the midship bridge. The vessel herself is divided into 14 tanks for carrying oil, and two cofferdams for water by means of 13 transverse and one longitudinal bulkhead, the whole of which are oil and watertight. The oil-tight bulkheads throughout have been subjected to the most rigorous test on both sides with a high pressure. The oil compartments are so arranged that they comply with the Suez Canal Regulations for carrying oil in bulk. She has a most complete installation of oil-piping consisting of a double line of suction pipes running all fore and aft, one in each side of the longitudinal bulkhead and quite distinct from each other, yet so arranged that either line can be used to empty either or both sides of the vessel. The discharge pipe runs all fore and aft with branches at intervals leading across to both sides of the ship, so that she can discharge no matter how moored. There is also a very powerful fan by Donkin & Nichol fitted to exhaust the vapour from each oil compartment after they have been emptied of oil. This vapour when mixed with air in a certain proportion forms a most dangerous explosive, and is one of the dangers of bulk oil carrying, yet it is believed that this arrangement, in combination with a system of steam sprayings which has been introduced for clearing the oil from off the skin of the vessel, will will form an efficacious means of eliminating the danger. The pump-room in this vessel is placed right forward of the oil compartments and contains a couple of Clarke Dowsen's valveless duplex oil pumps capable of pumping 400 tons of oil per hour. A most handsome and efficient installation of electric lighting, consisting of about 120 lights, has been fitted on board by Clarke Chapman & Co. Limited. The vessel is heated by steam right throughout all the cabins and men's quarters, and has steam cookers and boilers in the galley, thus obviating all necessity for fires when carrying oil. Her machinery, which has been constructed by the Wallsend Slipway and Engineering Co., Limited, consists of triple-expansion engines with cylinders 25½ in., 41 in., and 68 in. by 48 in. stroke, with three very large single-ended boilers which are fitted with "Serve" tubes manufactured by John Brown & Co., of Sheffield, and from which great economy in coal consumption is confidently expected. Upon the trial the vessel with her tanks full of water and bunker coal on board attained a mean speed of nearly 11 knots, giving the utmost satisfaction to all on board, among whom were Mr. Duffield, of Workington, chairman of the Northern Petroleum Tank Steamship Co., Limited, and Mr. C. S. Hunting, of the firm of Hunting & Son, Newcastle-on-Tyne, the managers of the above company, who are the owners of the vessel. During construction the vessel has been under the superintendence of Captain Brunton, and the machinery under that of Mr. Shaw, the able inspectors of Messrs. Hunting & Son.

Stefania.—On February 2nd the *Stefania*, a steel screw steamer, built by Messrs. Wigham Richardson & Co., at Newcastle, went for a trial trip off the Tyne. This vessel has been built to the order of the Royal Hungarian Sea Navigation Co., Adria, Limited, of Fiume and Budapest, and is 293 ft. in length by 40 ft. beam. She is fitted with triple-expansion engines. During the trial the machinery worked without the slightest hitch.

Indralema.—On February 3rd the *Indralema* left the port of Hartlepool to return to the Tyne, after having received her machinery at the Central Marine Engine Works. This is a large vessel built by Messrs. C. S. Swan & Hunter, of Wallsend, for Liverpool owners. The vessel made the run to the Tyne in a little over two hours against a strong tide and a westerly gale, the engines running seventy revolutions all the way without stop or heating or hitch of any kind.

Lytham.—On February 13th the twin-screw hopper steamer *Lytham*, constructed for the joint-service of the Lancashire and Yorkshire and London and North-Western Railway Companies at Fleetwood, was taken on her trial trip. This vessel was built by Messrs. Murdoch & Murray, Port-Glasgow, and engined by the contractors, Messrs. Rankin & Blackmore, Greenock. Her dimensions are:—Length, 130 ft.; breadth, 24 ft., and depth of hold, 9 ft. 6 in., and the hopper capacity is about 350 tons. With over 300 tons of dredged material on board, the trial on the measured mile at Skelmorlie resulted in an average speed of 9¾ knots, which is in excess of the guarantee.

Glasgow.—On February 14th the steamer *Glasgow*, which was recently launched by Messrs. W. B. Thompson & Co., Dundee, for Messrs. Rankine & Co., Glasgow, made a preliminary trial trip. Her engines worked very smoothly, and on the measured mile a speed of 13 knots was obtained.

Halifax City.—On January 15th the s.s *Halifax City*, built by Messrs. Alex. Stephen & Sons, Linthouse, for Messrs. Furness, Withy & Co., Limited, West Hartlepool, ran a very successful trial trip in the Firth of Clyde. The *Halifax City* is intended for the Nova Scotian and New Brunswick trade, and is commanded by Captain Harrison, the commodore captain of the Furness Line. The vessel is of steel, about 2,200 tons gross register, and built in excess of Lloyd's requirements for the highest or 100 A1 spar-deck class. In appearance she is a very favourable example of the best Clyde work, and the accommodation provided for about 40 first-class passengers is roomy, airy, and very attractive. Electric light is fitted throughout the entire vessel. The engines, also constructed by Messrs. Stephen, are of the most improved triple-expansion type, and of 300 N.H.P. The most complete and effective appliances are supplied alike for working the ship and for loading and discharging cargo.

Repton.—On Monday, February 19th, the s.s. *Repton* left the Tyne on her trial trip, and proceeded on her first voyage to Cardiff and Bombay. This vessel was built by Messrs C. S. Swan & Hunter, of Wallsend-on-Tyne, and engined by the Central Marine Engine Works, West Hartlepool, and is owned by Messrs. Galbraith, Pembroke & Co., of London. The *Repton* is a large vessel, 312 ft. B.P.; 41 ft. beam and 23 ft. 1½ in. moulded depth. She will carry about 4,400 tons deadweight, and is a fine specimen of a modern cargo steamer. On the trial trip the engines worked perfectly, there not being the slightest hitch of any kind. When running about 78 revolutions per minute the speed of the vessel was ascertained to be over 10 knots.

Clearwater.—On February 19th, the steamer *Clearwater*, which has been built by Messrs. Wigham Richardson, and Co., at Newcastle-on-Tyne, went for a trial trip off the coast. The *Clearwater* is a steel screw steamer, 240 ft. in length by 33 ft. beam. Everything worked without a hitch, an average speed of

about 14½ knots being attained. The steamer, which is owned by the New Orleans, Belize, Royal Mail and Central American Steamship Co., Limited, of New Orleans, has since sailed from the Tyne to enter upon her service between New Orleans and Central America.

Ribston.—On February 20th the trial trip took place of the s.s. *Ribston*. This vessel is a fine steel screw steamer, built by Messrs. W. Gray & Co., Limited, to the order of the London & Northern Steamship Co., Limited. Her dimensions are:—Length over all, 340 ft.; breadth, 43 ft., and depth, 28 ft. 9 in., and she takes Lloyd's highest class. Triple-expansion engines, having cylinders 24 in., 38 in. and 64 in. in diameter, with a stroke of 42 in., have been supplied by the Central Marine Engine Works of Wm. Gray & Co., Limited. The boilers are of steel, two in number, and work at 160 lbs. pressure per square inch. The vessel proceeded to sea about noon, having on board the managing owner, Mr. Pyman, Mr. Walter Pyman, Mr. George Pyman, junr., Capt. T. A. Pyman, who has superintended the building of the vessel; Mr. Crosar, the superintendent engineer, and Mr. T. Mudd, representing the engine builders. The compasses were adjusted by Mr. Berry, and the vessel ran for a few hours with the engines at about 75 revolutions per minute, there being too much fog to take any land observations regarding speed of ship. The machinery ran without the slightest hitch or trouble of any kind; the boilers steamed easily, and all parties were highly satisfied with the trial. As soon as the party had left the vessel by the tug boat, she proceeded on her voyage to Cardiff to load.

Columbia.—Steam yacht *Columbia*, a light-speed boat ordered by Harvey Ladew, of New York, from Wm. Cramp & Sons, S. B. & E. B. C., of Philadelphia, and recently completed, steamed on her trial 80·52 knots in 4 hours, 30 min., 43 secs., which is an average of 17·85 knots per hour, or 20·53 statute miles. The *Columbia* is of steel, 185 ft. over all, 180 ft. W.L., 23 ft. beam, 15 ft. deep, and 10 ft. 9 in. draught aft. She has a four cylinder triple-expansion engines of 1,800 H P., with cylinders 21½ in., 31 in., 34 in., 34 in., by 20 in. stroke. Steam is supplied by two steel return tubular boilers, working at 160 lbs. pressure. Average revolutions during trial, 235.

U.S.S. Montgomery.—Protected cruiser, and sister ship to the *Detroit*, built by the Columbian Iron Works, of Baltimore, steamed her official four hours' forced draught trial on Long Island Sound, with the result that she exceeded her contract speed by 2·04 knots, the official return showing an average speed of 19·04 knots. The vessel's principal features are:—Length, L.W.L., 257 ft.; beam, 37 ft.; draught, 14 ft. 6 in.; displacement, 2,070 tons. Engines triple-expansion, twin-screw, 26½ in., 39 in., 63 in., by 26 in. stroke; 6,200 I.H.P. The vessel has five boilers, with 365 square feet of grate surface and 10,960 square feet of heating surface. The screws are of manganese bronze, 11 ft. diameter and 12 ft. 6 in. pitch, with 32·1 ft. of surface. Coal capacity, 435 tons. The rig is that of a two-masted schooner, spreading 6,290 square feet of canvas. She is fitted with a Bath Iron Works steam windlass and capstan, Williamson steam steerer, Baird evaporator and distillery; Allen's dense air ice machine, and Sturtevant exhaust ventilating fans. Her armament consists of two 6-in. 100 pd. and eight 5-in. 50 pd. rapid-firing breech-loading rifles; six 6-pds. and two 1-pd. hotchkiss rapid-firing guns; two Gatlings, and a Howell and Whitehead torpedo. The speed of her sister ships were: *Detroit*. 18·71, and *Marblehead*, built by Hanson & Loring, Boston, 18·44 knots.

U.S.S. Olympia, protected cruiser of 5,500 tons, built by the Union Iron Works, of San Francisco. Her average speed during the four hours' forced draught test was 21·69 knots with 17,300 I.H.P. The engines of this vessel are precisely the same as those fitted in the *Columbia*, only this vessel has only two screws whereas the *Columbia* has three. The contract called for a sustained speed of 20 knots, with 13,500 H.P., but, as will be seen, this was greatly exceeded and the Union Iron Works earn 300,000 dols. premium. The *Olympia's* principal features are:—Length L.W.L., 340 ft.; beam, 53 ft.; draught, 21 ft. 6 in.; displacement, 5,500 tons; coal capacity, 1,300 tons; endurance at 10 knots 13,000 miles; complement, 466 men; protection afforded by 6 in. steel deck, cofferdams and coal storage. Has two masts with fighting and signalling tops. Armament four 8 in. B.L., ten 5 in. R.F.B.L., fourteen 6-pounders, six 1-pounders, ... kiss R.F.G., four Gatlings, and six torpedo tubes. Engine, ...xpansion, of 17,300 I.H.P.; cylinders, 42 in., 59 in., ...y 42 in.; revolutions, 135. Boilers, four double-ended eight-furnace and two single-ended four-furnace, the former 15 ft. 3 in., by 21 ft. 3 in., and the latter 15 ft. 3 in. by 10 ft. 8 in., working at 160 lbs. Grate surface, 824 sq. ft. Heating surface, 28,300 sq. ft. The vessel is constructed with a double bottom, the length of the machinery and boiler spaces. Is fitted with Williamson's steam steerer, capstan, and windlass and all modern appliances.

India.—The steam fishing-vessel *India*, the latest addition to the Grimsby fleet of trawlers, has lately been on her trial trip. She is the last of four built to the order of the International Steam Trawling Co., Limited, of Grimsby, and is fitted with a well for carrying live fish. Messrs. C. D. Holmes & Co. have fitted into her triple-expansion engines of 50 N.H.P., a large boiler working at 160 lbs. pressure, and their special winch, all of the latest and most approved type, the vessel being built by Messrs. Cochrane & Cooper, of Beverley. The *India* left the Hull Docks at 12 o'clock, and steamed down the Humber with a large party of those interested in this type of vessel on board. Her sea-going qualities and speed were thoroughly tested, the result showing 10¾ knots. During the whole of the trial the machinery worked without the slightest hitch, and to the entire satisfaction of the owners' representative, Mr. W. J. Wood. Mr. J. R. Smith represented the engineers, and Mr. Cochrane, the builders.

Miscellaneous.

Time and Tide; a supplement to the Glasgow Post Office and Railway Tables. Glasgow: Adam Henderson. On the 1st of January was published the first issue of a new monthly publication which is likely to prove itself of use to many of our readers. It contains a list of foreign ports with the steamers sailing thereto from every port in the United Kingdom during the forthcoming month. In many instances the dates fixed for homeward steamers are also given. Of course the chief steamers noted are those of mail and passenger lines but those of the principal cargo boats are also noted with a parenthetic intimation that they are for "goods only." Regulations and fixtures regarding the foreign and colonial parcel post, tide tables for the principal ports of the British Isles, and the adjacent parts of the Continent as well as some astronomical notes are added, and we see no reason why it should be suggested on the cover that the periodical is of mere local interest. It may be equally useful to all who are occupied with the business of shipping.

The Engineer's Gazette Annual for 1894. London: The Tower Publishing Company. Price, 1s. This is the sixth year of this publication and it will be found that the re-arrangement of matter and the additions tend to make it even more useful than it has hitherto been. The information about the Royal Naval Reserve, with especial reference to the engineering branch is an exceptionally useful addition, whilst, now that electricity is so much applied on ship board, the notes on that subject are sure to be appreciated. Owing to a new arrangement the tide table space is considerably reduced, and the pages thus freed are given up to special articles. One of these is on presence of mind. We thoroughly agree with the statement that that quality is one of the most useful to the engineer. He can never tell when he may be called upon to show it, nor when some emergency, calling for instant decision, may arise and give him the opportunity of saving both life and property, not to speak of the certain avoidance of delay which in these matters always means a great deal of money. We thoroughly agree that the cultivation of this quality is most important and though it is like poetry, more likely to be inborn than acquired, yet there is no doubt that by thinking as one is occupied with various parts of an engine of the possible and unlikely accidents which can befall it and the most advisable method of remedying them, it will be possible to ensure that one shall be ready when called upon in reality. The general information, tables and statistics are all well chosen and likely to be of use to engineers.

The Worthington Pumping Engine.—This catalogue, of date 1st November, 1893, is interesting to the engineer, as all the company's paper publications must be. But beyond this there is another interest to us, for this is an example also of very fine work also in other departments, and we regret to see that, though issued in England the credit for the execution of the book must be given to an American house,—that of Mr. James A. Rogers of New York. This is not a discouragemen of native

industry by the Worthington Co.,—for native industry is quite incapable of producing anything either in design or execution to compare with the beautiful reduced facsimile of the diploma which the company received from the World's Fair at Chicago. This forms the frontispiece of the present catalogue and a very casual glance will satisfy our readers that we are not exaggerating. The book contains descriptions and illustrations of large pumping engines made for special work by the company. The "high duty" type is shown with diagrams which are a very sufficient testimonial to its economy and with explanations of the various improvements and precautions in its arrangements, which their long and varied experience have shown to be advantageous. Then the "vertical type" which has been made in sizes ranging up to a fifteen million gallon capacity. The advantage of this is the limited floor space it requires. It is in appearance something of the marine engine style. Illustrations of large compound and triple-expansion engines with horizontal cylinders are also given, as well as the "vertical beam engine," which is designed for use where mud and grit have to be reckoned with. Smaller classes of pumping engines are referred to and an account given of the performances of engines supplied to various customers. Names and dates are in all cases given for verification, and it is apparent that the guaranteed capacity is always more than attained whilst the limit of estimated coal consumption is not reached. This leads us to suppose that the purchaser may count upon having more work done for less money than the makers would lead him to anticipate. The book closes with a satisfactory list of repeat orders, and a very long catalogue of the big engines turned out with their capacity date and destination. The water works and mines of the world do not have the monopoly of these conveniences for the Pipe Lines of North America have had a good number of engines specially designed for use with oil. The prices and dimensions are not given in the book but customers' attention is directed to the points most requisite for pump makers to know about their requirements and then they are invited to apply to Messrs. Worthington for a prescription absolutely suited to their own constitution and requirements.

The Southampton Almanack for 1894. By John Adams. Southampton: Adams & Dyer. This almanack contains the tide tables and local information regarding post office and steamship matters that we have noticed in former issues. To local people it must be invaluable. But this year its summary of the past events seems to have a somewhat wider interest. The taking over of the Southampton Docks by the London and South Western Railway Co., and the coming of the American line to the port with all the possibilities that are involved are naturally very fully dwelt upon. No doubt the town must benefit greatly. The wealthy railway company as dock owner, is a far better neighbour to a town than a not very prosperous dock company. Southampton had to struggle along for itself formerly: now the Railway cannot get a return upon the large capital it has sunk into the docks without "booming" the port and the town. The expenditure on the new graving docks must help the local tradesmen indirectly, and when the crews of the American liners make Southampton their head quarters, the fact must give a fillip to small house property and the local traders. If the American Line expands its present four vessels into a big fleet, the provisioning of such a concern must be a good thing for the town, and we do not wonder the writer of the summary sings a refrain of advancement. But there is another side to the shield, and he also complains somewhat. 'The traveller comes to Southampton, but in these rapid days he comes not to stay but to get through as quickly as may be. Thus the local tradesmen do not seem to benefit as much as perhaps some of them imagined. As we have said, the actual advantages to the local people are not altogether on the surface. The disadvantages are more easily seen. The talk about the great doings at Southampton brought great masses of unemployed into the town and some of the liners' firemen were not very desirable visitors. But all that will pass, and is after all but a very minor thing. Next year we may hope to notice that the chronicler has the opening of the new docks to remark upon, and perhaps, it may be, the advent of some British line to the port. Last year saw a new free library added to the public buildings, and 1894 is to see a new post office, whilst if the laudable proposal now being made is carried out a future time will bring a Sailors' Orphanage to prove that the town does not forget the wants of those who have lost their protectors in the service of the port.

Hull and District Institution of Engineers and Naval Architects.—The usual monthly meeting of the members of the above institution was held on Monday, February 5th, the president, J. Spear, Esq., in the chair. After the usual preliminary business, the chairman moved that a vote of condolence be sent to the widow of the late Mr. J. Jamieson (one of the vice-presidents of the institution), and in a few well-chosen words expressed the great loss the institution had sustained through his decease. Mr. F. Somerscales then read an able paper on "The Watertight Subdivision, and the Pumping Arrangements of the First-class Cruisers recently completed." The lecturer commenced by describing the arrangement of watertight bulkheads, indicating generally the position and the size of the various compartments, and the various purposes for which they were intended, separating them into groups according to their position in the ships. The different kinds of watertight doors adopted were next discussed, and finally a general description was given of the steam and hand pump services with the various sluice valves, drain-pipes, &c., in connection therewith. The lecture was illustrated by diagrams exhibiting the magnitude and extent of the work involved in connection with the subjects treated of. At the close of the discussion a hearty vote of thanks was accorded Mr. Somerscales for his valuable paper.

New American Contracts.—Messrs. Jackson, Sharp & Co., of Wilmington, to build a 125 ft. passenger propeller for Capt. W. Gerting, of Portsmouth, N.H. The engines and boilers to be built by the Pusey & Jones Co. Messrs. Jackson, Sharp & Co. to also build three small passenger propellers for M. N. Demprey, of Philadelphia. H. M. Bean, of Camden, Maine, to build for John Holmes, of Wareton, N.J., a four-masted wood schooner, of 1,900 tons. Dunn & Elliot, of Thomaston, Maine, to build a four-masted schooner (wood), of 1,000 tons. Capt. S. Percy, of Bath, Maine, to build a four-masted schooner (wood), of 1,850 tons. Charles V. Minott, of Phipsburg, Maine, to build a four-masted schooner (wood), of 1,400 tons. Chicago Shipbuilding Co. to build a large steel freight steamer for Chicago Syndicate. Length of keel, 324 ft.; beam, 41 ft.; depth, 28 ft. The engines and boilers will be built by the Cleveland S. B. Co., the engines being triple-expansion, with cylinders 23 in., 38 in., and 60 in., by 40 in. stroke. Boilers are two in number, and each will be 13 ft. long and 14 ft. in., diameter. The Globe Iron Works will build three steel tow-boats for L. P. and J. A. Smith. The dimensions are:—(1) 80 ft. by 18 ft. by 12 ft.; (2), 55 ft. by 14 ft. by 8 ft.; (3), 70 ft. by 16 ft. by 9 ft. The same firm has also contracted to build a 300 ft. steel freight steamer for Cleveland parties. The Charles Hulman S.B. & E.B. Co., Atlantic Works, Boston, and the Standard Contracting Co., Cleveland, have also orders on hand for small tow-boats.

Recent applications for Patents connected with Marine Engineering, Ship Construction and Mechanical Appliances for use in Ships, from January 12th, 1894, to February 6th, 1894.

661 A. J. Boult. (R. Noury, France.) Ships' steering gear.
676 W. Humberstone. Preventing boiler explosions.
677 T. E. Bickle. Adjusting the load of pumping engines.
691 A. A. Voysey. Torpedoes.
719 Z. W. Baugh. Boilers and furnaces.
722 G. L. Addenbrooke. (R. Macdonald, Australia.) Marine engine governor.
729 J. J. Hicks. Facilitating the steering of boats.
741 H. Baschy. Removing scale from boiler stays.
759 J. S. Raworth. Construction of steam turbines.
774 A. Smith. Life-buoys.
845 R. Schumann. Registering compressed steam.
862 J. B. Burrell. Packing rings of pistons for pumps.
865 J. Wilson. Screw propeller.
870 H. Campbell. Piston of oil motor engines.
905 J. W. Restler. Multiple expansion engines.
931 J. Tucker. Fastenings for ships' hatchways.
932 R. Innes and W. Jackson. Preventing corrosion.
936 J. Leigh. Lubricating glands of engines.
951 S. H. James. Boats and ships.
980 W. P. Thompson. (J. A. Guest and J. H. Bates, United States.) Life-buoys.

982 J. M. Wright. Lubricators.
997 L. Serpollet. Boilers.
1025 T. Barnfather and C. Kübler. Automatic governor.
1027 A. Pengelly. Boats' rowlocks.
1079 W. H. Harfield. Ships' steering gear.
1108 H. Lindley. Speed governors.
1116 J. Cockburn. Metallic and composite hose.
1117 J. Cockburn. Improved composite hose.
1129 R. H. Brunton. Screw for forcing pulp into hollow cylinders.
1155 F. Baker. Fog signalling apparatus.
1156 T. Utley. Ship's side lights.
1167 A. O. Stopes. Preventing boiler explosions.
1180 J. Tildesley. Cap ferrules for boiler tubes.
1230 G. W. S. Lennox. Boilers of steam engines.
1246 E. Edwards. (E. Gacock, Germany.) Ironclad ships.
1256 F. R. Stewart. Feed-water filter for boilers.
1281 O. Imray. (C. A. G. Storz, Germany.) Propeller apparatus for vessels.
1297 R. Schulz. Steam generators.
1299 T. Henderson. Induced draught apparatus.
1318 F. A. Bishop. Ships' logs.
1358 W. H. and R. W. Allen. Steam engines, &c.
1385 A. Miskin. Producing propulsion of boats.
1393 E. M. Hollingsworth. Preventing boilers exploding.
1420 D. Yeer. Setting steam boilers.
1436 L. Gye. Packing of piston-rods and shafts.
1517 N. G. Thompson and G. W. Cooper. Funnels.
1529 W. A. Mackie. Masts and rigging of vessels.
1531 J. G. Alder and T. M. Alder. Thrust block.
1538 B. Talbot. Bottom plate for steel ingot moulds.
1632 E. G. M. Donnithorne. Boilers for marine engines.
1634 J. E. Carroll. Heating boiler feed-water.
1664 W. W. Branston. Sight-feed lubricators.
1693 J. B. King. Slide valves for steam engines.
1694 G. Gabriel. Stop valves for steam vessels.
1721 J. C. Wilson. Circulation of water in boilers.
1739 J. W. and J. Grant. Raising sunken vessels.
1740 A. H. Messier. Controlling delivery of feed-water.
1761 W. P. Thompson. (L. Lang, Austria.) Metal plates for ships.
1770 W. R. Barter. Safety arrangement for boilers.
1773 W. Judd. Combination rule and compasses.
1790 D. Stewart. Centrifugal apparatus.
1792 G. V. Priestley. Steam generators.
1802 T. R. Dowson. Steam engines.
1803 W. Hall. Metallic packing for engine stuffing boxes.
1823 D. Cook. Engines and methods of propulsion.
1855 J. Justus. Coverings for steam pipes.
1891 G. H. Firth and the Clayton Foundry Co., Limited. Compound steam engine.
1910 J. Wotherspoon and J. Davie. Filtering feed-water.
1911 F. W. Brewster. Drop-keel apparatus for yachts.
1994 M. H. C. Shann. Water-tube boilers.
2000 M. H. C. Shann. Boilers.
2005 C. F. de Kierzkowski-Steuart. Internal combustion motors.
2016 G. C. Marks (The Hogan Engineering Co., United States). Boilers.
2064 H. F. Foster. Internal combustion engines.
2085 J. J. and F. T. Meldrum. Condensers.
2086 J. Duggan. Propelling navigable vessels.
2108 A. Miller. Heating of feed-water for steam boilers.
2117 J. Richardson. Compound steam engines.
2222 G. H. T. Beamish. Sailing vessels.
2231 E. F. Boulet. Piston packings.
2244 J. Roots. Propellers.
2269 S. E. Wellington. Internal combustion engines.
2271 C. R. G. Smythe and A. H. Dunnachif. Manhole.
2315 J. Y. Johnson (La Societé Augustin Normand & Cie., France). Steam generators.
2328 T. W. Felton. Tube-plate hole cutter.
2405 J. Haas. Screw dredger.
2440 G. V. Priestley. Improved steam generators.
2456 H. H. Lake (H. A. Harvey, France). Armour plates.
2459 D. J. Dunlop. Hoisting gear for loading ships.
2480 W. H. Morgan. Floors of manholes, &c.
2498 H. Kohl. Feed-water heater.
2506 T. G. Stevens. Steadying screw for rudder-heads.
2556 W. Fairweather (A. Walrath, United States). Boiler composition.
2557 W. Jones. Belting.
2581 W. T. Langley-Smith. Ship's Propellers.
2621 C. S. Galloway. Tubulous steam generator.
2622 A. Horne and J. B. Furneaux. Heating feed-water.
2627 W. Allison. Automatic logs for marine use.

BOARD OF TRADE EXAMINATIONS.

NOTE.—1C, denotes First Class; 2C, Second Class.

January 27th, 1894.

Anderson, A. G.	1C	Aberdeen
Bennion, H. R.	2C	Cardiff
Berry, Fred R...	2C	,,
Berry, Joseph S.	2C	Liverpool
Butter, W. McE.	1C	Aberdeen
Clark, J. C.	2C	Sundrlnd
Coutts, Robert...	1C	,,
Elliott, R. G....	2C	Hull
Evans, William.	2C	Cardiff
Fowler, W. R. ..	1C	South'ton
Hamill, Patrick J.	2C	Liverpool
Hire, George A...	1C	Cardiff
Jones, John E...	2C	,,
Lapish, F. W...	2C	Hull
McRae, David...	1C	Aberdeen
Musson, William.	2C	Liverpool
Paterson, Geo. M.	2C	,,
Paterson, Wm. J.	2C	,,
Peacock, Fred...	1C	Hull
Philip, David. ..	1C	Aberdeen
Philip, T. R.....	1C	,,
Pitt, Robert W.	2C	Cardiff
Procater, Fred M.	2C	Liverpool
Scott, John.	1C	London
Wade, Henry. ..	2C	Cardiff
Walsh, William.	1C	Liverpool
Wilson, R. S.....	2C	London
Woeliscroft, J. H.	2C	Liverpool

February 3rd, 1894.

Arnesen, Olaf. ..	1C	N.Shields
Bowman, R. S. ..	2C	,,
Bush, Chas. P...	2C	London
Campbell, Thos.	1C	Glasgow
Corbett, Frank R.	1C	London
Diggle, Wm. F...	2C	Liverpool
Dunning, C. E...	2C	N.Shields
Fyte, Saml.	2C	Glasgow
Godfrey, Thos...	2C	London
Gray, David....	1C	Liverpool
Hislop, John	1C	,,
Johnstone, Robt.	2C	Glasgow
Knowles, Geo...	1C	,,
Lawther, Wm. E.	2C	N.Shields
M'Farlane, D. D.	1C	Glasgow
Pratt, Middleton	2C	Liverpool
Putham, Geo. S.	1C	London
Raby, Francis S.	1C	N.Shields
Reid, Thomas A.	2C	Liverpool
Slater, Douglas..	2C	N.Shields
Smith, Wm.	2C	Glasgow
Thompson, J. H.	2C	Liverpool
Varian, Alfred D.	1C	,,
Venables, H.W.C.	2C	,,
Vos, Fredk. N...	1C	Falmouth
Wawn, D.......	2C	N.Shields
Whitfield, Ernest	2C	,,

February 10th, 1894.

Baxter, David...	1C	N.Shields
Burn, David....	1C	,,
Burtt, Thomas J.	2C	,,
Coop, Hy.......	2C	Hull
Dunlop, Arch...	2C	London
Eividge, Ernest	2C	Hull
Elliott, William	1C	Liverpool
Field, Oswald J.	2C	Hull
Gibson, Thom.H.	2C	N.Shields
Gray, William..	2C	,,
Hatton, Robt. W.	2C	London
Higgins, John F.	2C	N.Shields
Hutchinson, W.H.	1C	Liverpool
Lovely, John G.	1C	N.Shields
Mannix, Patrick	1C	Liverpool
Marsack, Wm. A.	1C	London
Munro, Wm. J...	1C	Liverpool
Proud, George ..	1C	N.Shields
Slater, James ..	2C	London
Stackie, James R.	2C	N.Shields
Stanger, Thos. W.	2C	,,
Todd, Daniel H.	2C	Hull
Wastell, James S.	2C	N.Shields
Wilson, James..	2C	Liverpool

February 17th, 1894.

Bailie, Jas.	2C	Dublin
Ball, Saml. John	2C	Plymouth
Bell, Alexander..	1C	Liverpool
Brierley, Albert	1C	London
Brough, Wm. R.	1C	N.Shields
Brown, Jas. Wm.	2C	,,
Campbell, R. H.	2C	Greenock
Clark, Wm. H...	2C	,,
Clow, Hy. N. ..	1C	,,
Cohen, H.	1C	London
Corney, David W.	1C	N.Shields
Cox, Thos. D...	2C	,,
Cuber, James S.	2C	Leith
Cunningham, T.	1C	London
DeGruchs, A. S.	1C	Greenock
Hewells, Wm. H.	1C	N.Shields
Hogg, Thos.....	2C	,,
Holmes, Edwin..	2C	Liverpool
Hughes, Jno.....	1C	Dublin
Killiner, Francis	1C	,,
King, Jno.......	1C	Greenock
Kinghorn, Jas. R.	2C	Leith
Malcolm, Alex. F.	2C	,,
McCallum, G. C.	2C	Liverpool
M'Gregor, W. ..	1C	Leith
Mills, Ernest P.	2C	Liverpool
Moffat, Robert C.	1C	,,
Moyes, Andrew..	2C	Leith
Murphy, Wm. A.	1C	N.Shields
Murray, Wm. G.	1C	Greenock
Musset, Geo. W.	2C	N.Shields
Nicholson, R. J.	2C	Hull
Patterson, Walter	2C	Leith
Peat, David	2C	,,
Pether, Wm. R.	1C	London
Purdon, Jno.....	2C	Greenock
Rewcastle, Jno...	1C	,,
Schneider, Carl	1C	Leith
Scott, Jno. B...	2C	,,
Shaw, David U.	1C	N.Shields
Smith, Jno. M...	1C	,,
Smith, Jno.	1C	Leith
Stratton, Jas. M.	1C	,,
Tully, Richard..	1C	N.Shields
Weir, Andrew G.	2C	Leith
Weir. Wm.......	2C	Dublin